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# PUBLICATIONS OF THE SETO MARINE BIOLOGICAL LABORATORY

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SIRAHAMA, WAKAYAMA-KEN, JAPAN
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# ON SOME PYCNOGONIDS FROM THE SEA AROUND KII PENINSULA*

HUZIO UTINOMI

*With 2 Text-figures*

The Pycnogonida occurring around the coast of Kii Peninsula have been scarcely examined. So far as I am aware, only two species, *Lecythorhynchus hilgendorfi* and *Ammothea (Ammothella) bi-unguiculata*, both found living commensally with sea-cucumbers, have ever been reported by OHSHIMA (1927 a, b) from Seto. Very recently, HEDGPETH (1949) recorded eight species collected by the Albatross Expedition in 1900 and 1906 from deep waters of Kii area. The present account is based upon a small collection deposited in the museum of the Seto Marine Biological Laboratory. The great majority were secured by Mr. S. SAKAGUCHI from bottom materials dredged at 100 to 200 meters depth off Minabe, not far from the Laboratory, but a few of the specimens were collected by myself and other members of the Laboratory in the neighborhood of Seto, where the Laboratory is located (UTINOMI, 1950).

In all, ten species belonging to six genera, of which two seem to represent new species, have been examined. Most of the more detailed information together with measurements of species and ecological notes will be left for a future more comprehensive paper. Here follows a preliminary list of the species seen by myself at Seto from inshore waters:

*Nymphon japonicum* ORTMANN
*Pallenopsis tydemani* LOMAN
*P. virgatus* LOMAN
*Achelia superba* (LOMAN)
*A. kiiensis* n. sp.
*A. ohshimai* n. sp.
*Ascorhynchus japonicus* IVES
*A. glabroides* ORTMANN
*Lecythorhynchus hilgendorfi* BÖHM
*Colossendeis dofleini* LOMAN

Before going further, I should like to extend my hearty thanks to Dr. Hiroshi OHSHIMA, M.J.A. for his kind advice and for reading the manuscript.

## Family NYMPHONIDAE

### 1. *Nymphon japonicum* ORTMANN

*Nymphon japonicum* ORTMANN 1891, pp. 158-159; LOMAN, 1911, p. 8; OHSHIMA,

* Contributions from the Seto Marine Biological Laboratory, No. 157.

1936, p. 862; HEDGPETH, 1949, pp. 249-250.

*Material*. Off Minabe, 100-200 m deep. 59 specimens. March, 1944.

HEDGPETH (1949) has shown that *Nymphon japonicum*, figured by OHSHIMA and KISHIDA (1947) in the "Illustrated Encyclopedia of the Fauna of Japan", p. 1007, does not agree exactly with the original figure by ORTMANN but probably referable to his *N. micropedes*. Most of the material at hand also indicate the subequal length between the tarsus and propodus which is characteristic of this species. The body is elongate, about 10-15 mm in length, including proboscis, and the walking legs are very slender and more elongate, about 40 to 55 mm long.

This is a very common deep water species found in Japan, ranging from Tsugaru Strait to the South of Kagoshima Bay.

## Family PALLENIDAE

### 2. *Pallenopsis tydemani* LOMAN

*Pallenopsis tydemani* LOMAN, 1908, pp. 65-66; HEDGPETH, 1949, p. 277.

*Material*. Off Minabe, 100-200 m deep. 1 ovigerous male. March, 1944.

Trunk 6 mm, proboscis 2.7 mm, abdomen 1 mm.

HEDGPETH first records this Malayan species from Japanese waters, namely Albatross Station 4908 (off Koshiki-zima, 434 fathoms).

### 3. *Pallenopsis virgatus* LOMAN

*Pallenopsis virgatus* LOMAN, 1908, pp. 69-70; HEDGPETH, 1949, pp. 277-278.

*Material*. Off Yuzaki, 25-35 m. deep. 1 male. 14 August, 1934.

Ever recorded from Siboga Station 310 (north of Sumbawa Is, 73 m) and from Albatross Station 3730 (SW of Omaé-saki, 34-37 fathoms).

This species is characterized by the presence of paired tubercles on the dorsal margin of the first coxa and by the strong auxiliary claws which are a little shorter than the terminal one on the propodus. Trunk 4 mm, proboscis 3 mm, abdomen 2 mm, third lateral process 1.5 mm, third leg 31.5 mm.

## Family AMMOTHEIDAE

### 4. *Achelia superba* (LOMAN)

*Ammothea superba* LOMAN, 1911, pp. 11-12; OHSHIMA, 1936. p. 866.
*Achelia superba* HEDGPETH, 1949, p. 287.

*Material*. Three specimens, obtained from Tanabe Bay in May, 1937, have been lost by the earthquake of 1946. No data are thus available.

An endemic species recorded from Sagami Bay, Tokyo Bay and E. of Sagalien, occurring from 80 to 180 m in depth. I have not ever collected from the shore along Tanabe Bay.

## 5. *Achelia kiiensis* nov. sp.

(Fig. 1)

*Material.* A single male (holotype). Tanabe Bay, 5-10 m deep. 15 April, 1938, taken by a beach seine.

*Description.* Trunk short, oval in outline or disk-shaped, unsegmented. Lateral processes contiguous throughout their length, each tipped with a pair of laterodorsal tubercles and a longer posterolateral tubercle, each of which bears a few short stiff bristles at the apex. Cephalic segment without neck, widened anteriorly and ending on each side in a large protuberance tipped with a bristle, like lateral process. Besides, there are two or three smaller tubercles bearing a bristle between eye tubercle and frontolateral protuberances. Eye tubercle situated close to frontal edge, moderately high, bluntly pointed, with four well-marked eyes near summit. Dorsal surface of main trunk slightly swollen and smooth; integument granular, deep brown in colour.

Abdomen long slender, slightly swollen distally, quite reaching to distal end of first coxal segment of last legs, but slightly bent upward. It is armed near tip with a few spines.

Proboscis heavy, broadly oval, a little longer than trunk.

Chelifore about one-third as long as proboscis, 2-jointed; chela almost round, about one-fifth as long as scape or basal segment; both segments bear each a short spine distally.

Palpus 8-jointed; first two segments longer than chelifore, second and fourth subequal, about four times as long as first one, fifth to eighth all very short, subequal, and thickly clothed with bristles.

Oviger rather heavy, 9-jointed; first segment stout, not much longer than wide; second and third subequal in length but a little longer than first; fourth and fifth slender, subequal in length, about three to four times as long as wide, subtriangular in outline, with a strong reversed spine at base; seventh and eighth armed each with a tuft of long bristles at dorsal distal corner and also ventrally with a denticulate spine, the former segment longer and wider than the latter; terminal ninth smaller than preceding, armed ventrally with three heavy denticulate spines, but no bristle.

Legs long, almost uniform in length, rather stout, knobby, covered with scattered spines, terminating in well-developed claw and pair of strong auxiliary

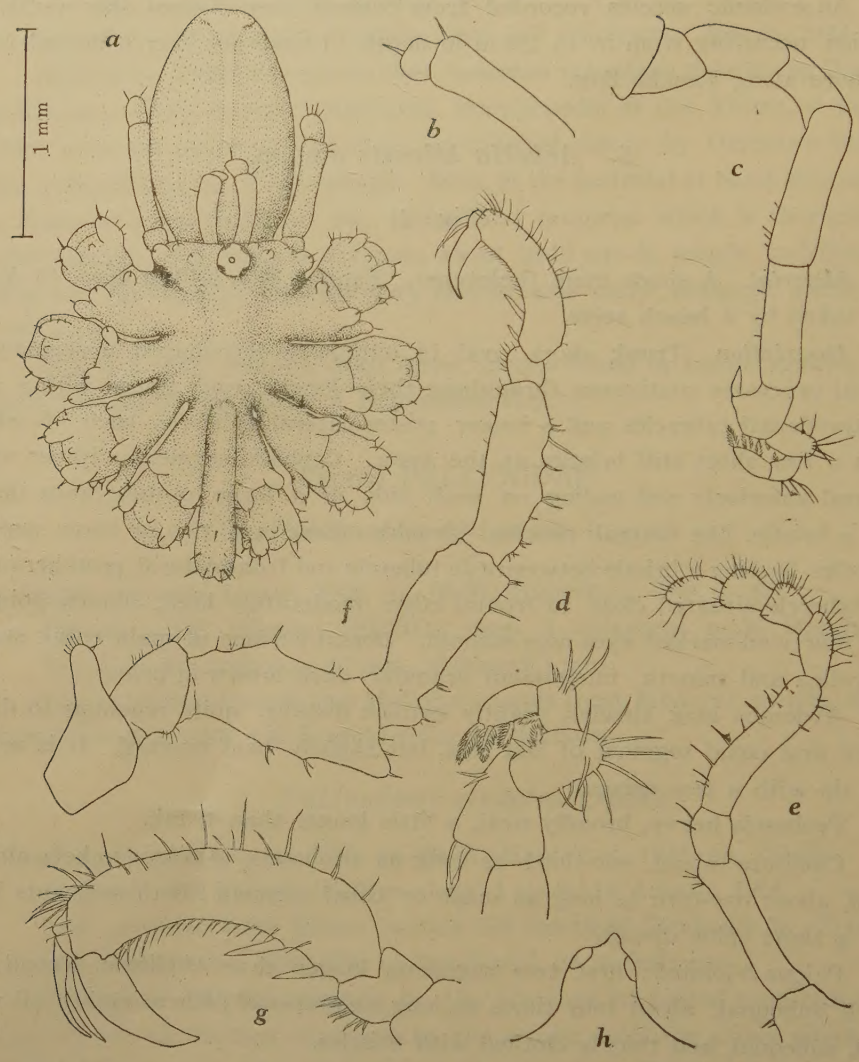


Fig. 1. *Acholia kiiensis*, n. sp. (♂) *a*, Dorsal view of holotype, ×27, *b*, chelifore, ×53; *c*, oviger, ×33; *d*, terminal joints of oviger, ×63; *e*, palpus, ×33; *f*, third leg, ×27; *g*, tarsus and propodus ×53; *h*, eye tubercle, ×53.

claws. Coxa I armed dorsally with a pair of large round tubercles bearing a few short bristles, and posterolaterally with one or two smaller tubercles, as in lateral processes, and also armed dorsomedially with a nude, minute tubercle between these distal tubercles; coxa II armed with lateral tubercles but no paired dorsal tubercles; coxa III as long as wide, armed on both sides with several bristles; femur about twice as long as wide, heavy, armed distally with a strong protuberance; tibia I and II subequal in length, a little shorter than

femur, armed dorsally with several short or long spines; tarsus very short, armed ventrally with short spines; propodus stout, curved ventrally, armed dorsally with a row of long spines, ventrally in proximal part with two widely-separated heavy spines, distally with numerous small spines; terminal claw very strong, curved; auxiliary claws slender but over half as long as claw. Genital aperture of male occurs on long protuberance on ventral distal margin of second coxae of two posterior legs, the protuberance being about as long as the width of coxal segment.

| *Measurement in mm.* | | Third leg: | |
|---|---|---|---|
| Proboscis | 1.36 | Coxa I | 0.35 |
| Trunk, length | 1.0 | Coxa II | 0.48 |
| Trunk, width (incl. 2nd lateral proc.) | 1.6 | Coxa III | 0.44 |
| Abdomen | 0.9 | Femur | 1.1 |
| Chelifore | 0.4 | Tibia I | 1.0 |
| Eye tubercle | 0.2 | Tibia II | 0.9 |
| | | Tarsus | 0.2 |
| | | Propodus | 0.8 |
| | | Terminal claw | 0.44 |

*Remarks.* This species seems to be closely akin to *Achelia superba* (LOMAN), *A. alaskensis* (COLE) and *A. echinata* (HODGE) in the arrangement of tubercles on the lateral processes and coxae of legs, but differs from them in its minor details and in having 5 denticulate spines and a simple reversed spine on the oviger. As to the latter feature, it agrees well with *A. bituberculata* HEDGPETH from Misaki, but differs notably in lacking dorsal trunk tubercles. The propodus, having 2 large spines on the heel, is also characteristic.

## 6. *Achelia ohshimai* nov. sp.

(Fig. 2)

*Material.* A single female (holotype). Hatake-zima in Tanabe Bay, under stones between tidal marks. 14 July, 1950, collected by Mr. I. YAMAZI.

*Description.* Trunk disk-shaped, unsegmented, lateral processes contiguous. Cephalic segment widened anteriorly, exceedingly raised with eye tubercle from the rest, and provided anteriorly with a small tubercle between eye tubercle and large frontolateral tubercle on each side. Eye tubercle tall, with four elongate eyes in the middle. Abdomen fingerlike, nearly reaching to distal end of second coxae of last legs; it is armed on the dorsal surface with three spiny processes, a strong one basally, a small medially and a slight almost distally. So the back of main trunk between eye tubercle and abdomen is

deeply sunken, showing somewhat a saddle-shaped appearance.

Lateral process armed distally with a pair of dorsal tubercles, of which the posterior one is invariably larger than the anterior, and usually bears a bristle at the tip. Each of anterior two processes also armed with a small posterolateral tubercle.

Proboscis very broad, pyriform, longer than trunk.

Chelifore short, about one-third as long as proboscis, 2-jointed, with a globular subchela; scape about three times as long as chela with a strong spiny process at apex and a little smaller one at middle.

Palpus hook-like, longer than proboscis, the four terminal segments thickly clothed with bristles.

Oviger short, slender, 10-jointed; first to third segments subequal in length, fourth and fifth subequal in length but slightly longer than the preceding one, sixth a little shorter than fifth, simple, without reversed spine, four terminal segments from seventh to tenth simply curved like a hook, armed ventrally with denticulate spines, 2 on the seventh, 1 on the eighth, 1 on the ninth, and 2 on the tenth.

Legs almost uniform in length, not much knobby, with a few scattered spines. Coxa I armed dorsally with a pair of tubercles as in lateral processes, and a smaller posterolateral tubercle on the anterior two legs only; coxa II nude, without distinct genital process; coxa III slightly shorter than coxa II; femur about twice as long as wide, armed distally with a short protuberance; tibia I and II subequal in length, a little shorter than femur; tarsus very short; propodus curved, with three large spines on heel. Terminal claw very strong, curved, half as long as propodus; auxiliary claws rather strong, but usually more than half as long as terminal claw.

| *Measurements in mm.* | | Fourth leg: | |
|---|---|---|---|
| Proboscis | 1.1 | Coxa I | 0.39 |
| Trunk | 0.8 | Coxa II | 0.39 |
| Abdomen | 0.7 | Coxa III | 0.33 |
| Chelifore | 0.4 | Femur | 1.0 |
| Oviger | about 1.5 | Tibia I | 0.8 |
| | | Tibia II | 0.9 |
| | | Tarsus | 0.15 |
| | | Propodus | 0.8 |
| | | Terminal claw | 0.44 |

*Remarks.* This species resembles the preceding *A. kiiensis* (n. sp.), but differs from it in the saddle-shaped back of the trunk together with the peculiar adornment of the abdomen and chelifore. It is further distinguished by

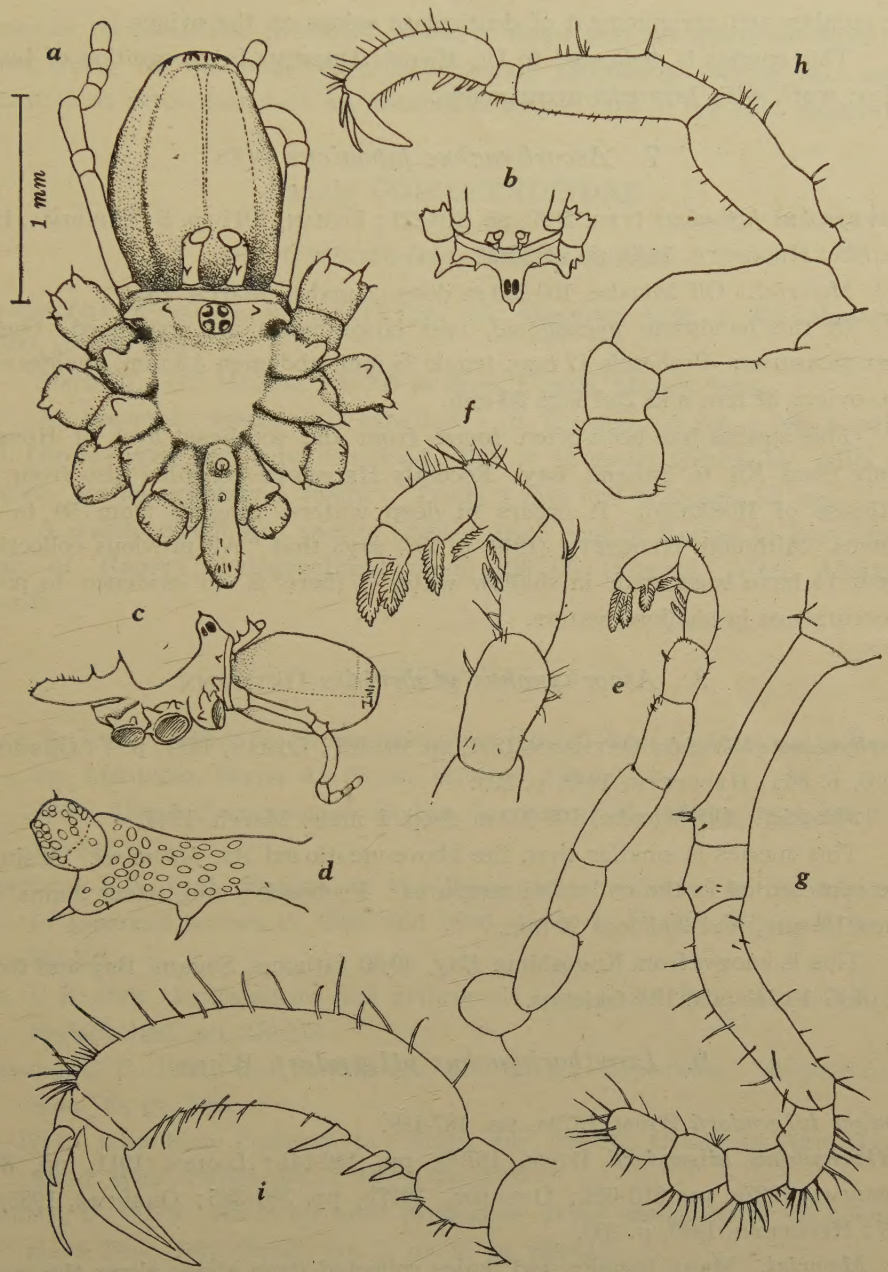


Fig. 2. *Achelia ohshimai*, n. sp. (♀) *a*, Dorsal view of holotype, ×27; *b*, frontal view of anterior region; *c*, lateral view; *d*, chelifore, ×80; *e*, oviger, ×53; *f*, terminal joints of oviger, ×96; *g*, palpus, ×53; *h*, fourth leg, ×27; *i*, tarsus and propodus, ×67.

the number and arrangement of denticulate spines on the oviger.

This species is dedicated to Dr. Hiroshi OHSHIMA in recognition of his excellent work with Japanese pycnogonids.

### 7. *Ascorhynchus japonicus* IVES

*Ascorhynchus japonicus* IVES, 1892, pp. 219-221; LOMAN, 1911, p. 5; OHSHIMA, 1936, p. 865; HEDGPETH, 1949, pp. 292-293.

*Material.* Off Minabe, 100-200 m deep. 2 males. March, 1944.

Of this handsome pycnogonid, two large males are examined. One of them measures: Proboscis 17 mm, trunk 35 mm, abdomen 4.5 mm, chelifore 4.5 mm, oviger 32 mm and 2nd legs 80 mm.

This species has been often found from the southeast area of Honsyū, chiefly from Kii to Sagami Bay. Recently HEDGPETH recorded also from the northeast of Hokkaido. It occurs in deep waters, ranging from 50 to 918 fathoms. Although HEDGPETH (1949, p. 293) says that "All previous collections appear to have been made in shallow water", there is no evidence to prove its occurrence in shallow waters.

### 8. *Ascorhynchus glabroides* ORTMANN

*Ascorhynchus glabroides* ORTMANN, 1891, pp. 160-161; LOMAN, 1911, p. 7; OHSHIMA, 1936, p. 865; HEDGPETH, 1949, p. 293.

*Material.* Off Minabe, 100-200 m deep. 1 male. March, 1944.

This species is smaller than the above-mentioned *As. japonicus.* A single male represented in the collection measures: Proboscis 5 mm, trunk 9 mm, abdomen 1.8 mm, and 2nd legs 20 mm.

This is known from Kagoshima Bay, 40-50 fathoms, Sagami Bay and from SW. of Gotō Islands, 139 fathoms.

### 9. *Lecythorhynchus hilgendorfi* BÖHM

*Corniger hilgendorfi* BÖHM, 1879a, pp. 187-189.

*Lecythorhynchus hilgendorfi* BÖHM, 1879b, pp. 140-141; LOMAN, 1911, pp. 8-9; OHSHIMA, 1927a, pp. 610-611; OHSHIMA, 1927b, pp. 380-385; OHSHIMA, 1936, p. 867; HEDGPETH, 1949, p. 296.

*Material.* Many females and males collected from shore along the coast of Kii from Kada to Kushimoto.

This is a typical littoral species occurring commonly around the coast of Japan, ranging from Akkeshi Bay, Hokkaido (OKUDA, 1934) to Tomioka, Kyūsyū (OHSHIMA, 1936). In the neighborhood of Seto it is sometimes found under

stones or on corallines. Ohshima (1927a, b) notes that his specimens have been found living on the body of a holothurian, *Holothuria lubrica* var. *moebii* (Ludwig) at Seto. But such an instance is rather rare in my field observation.

## Family COLOSSENDEIDAE

### 10. *Colossendeis dofleini* Loman

*Colossendeis dofleini* Loman, 1911, pp. 4-5; Ohshima, 1936, p. 867; Hedgpeth, 1949, p. 300.

*Material*. Off Minabe, 100-200 m deep. 1 male. March, 1944.

An imperfect specimen is examined; of the appendages, a leg, a palpus and two ovigers are only remained. But it is easily identifiable with this species. Its measurements follow: Trunk 4 mm and proboscis 5.5 mm.

A widely distributed species ranging from east of Kuriles to Ensyū-nada, south of Honsyū; bathymetrical range 229-505 fathoms (after Albatross records).

## REFERENCES

Böhm, R. 1879a. Ueber die Pycnogoniden des Königl. Zoolog. Museums zu Berlin, etc. Montsber. Berlin Ak. Wiss., 1879, pp. 170-197.

—— 1879b. Ueber Pycnogoniden. Sitzber. Ges. Naturf. Fr. Berlin, 1879, no. 9, pp. 140-142.

Hedgpeth, J. W. 1949. Report on the Pycnogonida collected by the Albatross in Japanese waters in 1900 and 1906. Proc. U. S. Nat. Mus., vol. 98, pp. 233-321.

Ives, J. E. 1892. Echinoderms and arthropods from Japan. Proc. Acad. Nat. Sci. Philad., 1891, pp. 210-223.

Loman, J. C. C. 1908. Die Pantopoden der Siboga Expedition. Siboga-Exped., mon. 40, pp. 1-86.

—— 1911. Japanische Podosomata; Beitr. zur Naturg. Ostasiens. Abh. Bayer. Akad. Wiss., Suppl., Bd. 2, Pt. 4, pp. 1-18.

Ohshima, H. 1927a. Notes on some pycnogons living semiparasitic on holothurians. Proc. Imp. Acad., vol. 3, no. 9, pp. 610-613.

—— 1927b. Piknogonoj alkrocigantaj al Holoturioj. Bulteno Scienca (Fakult. Terkultura, Kjusu Imperia Univ.), vol. 2, no. 5, pp. 380-388. (in Japanese with Esperanto résume)

—— 1936. A list of Pycnogonida recorded from Japanese and adjacent water. Zool. Mag., vol 48, no. 8-10, pp. 861-869. (in Japanese)

OKUDA, S. 1934. On a tubicolous polychaete living in commensal with a pycnogonid. Annot. Zool. Japon., vol. 14, no. 4, pp. 437-439.

ORTMANN, A. E. 1891. Bericht über die von Herrn Dr. Döderlein in Japan gesammelten Pycnogoniden. Zool. Jahrb., Abt. Syst., Bd. 5, nr. 1. pp. 157-168.

UTINOMI, H. 1950. Pycnogonida from Kii Province. Nanki Seibutsu, vol. 1, no. 3, pp. 127-132. (in Japanese, mimeographed)

# CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA IV.

## NOTES ON SOME ASCIDIANS COLLECTED IN ÔSAKA BAY (1)*

TAKASI TOKIOKA

*With Plate XI and 8 Text-figures*

The present material consists of 14 species collected by Mr. R. ISIBASI at Ozaki on the east coast of Ôsaka Bay, exactly midway between Ôsaka and Wakayama. I wish to express here my hearty thanks to Mr. ISIBASI for his kindness in offerring me the material, and to Prof. T. KOMAI for his incessant encouragement and kind guidance.**

### 1. *Distaplia japonica* n. sp.

(Fig. 1)

Two colonies incrusting *Sargassum*, preserved in formalin. Test semi-transparent, steel-blue in colour and sprinkled with white zooids in one colony, while it is grayish white and sprinkled with yellowish brown zooids in the other. Thickness of colony 2-3 mm. System rather distinct; smaller systems consist of ca. 10 zooids and 3-4 mm in diameter, larger ones contain 20-30 zooids and reach 12 mm along the long axis.

*Thorax*: Length about 1 mm in strongly contracted condition. Abdomen slightly larger than the contracted thorax. Branchial aperture 6-lobed. Atrial languet conspicuous; tip simple or divided into three lobes.

*Abdomen*: Oesophagus enters the stomach horizontally. Stomach ovoid, with ca. 15 irregular faint longitudinal plications on the surface. Gonad in the intestinal loop. Testicular follicles less than 10, usually 6-9 in number. Pericardium on the opposite side of the gonad. Trunk of larva about 1 mm in length.

*Remarks*: *D. occidentalis* BANCROFT, distributed along the western coast of North America, has the gonad situated posterior to the intestinal loop in

* Contributions from the Seto Marine Biological Laboratory, No. 158.

** A part of the expense for the study was defrayed from the grant by the Ministry of Education.

Fig. 1. *Distaplia japonica* n. sp. 1-A part of colony, ×1.5; 2-Zooid, ×45; 3-Abdomen, ×45; 4-Larva, ×45.

adult specimens. *D. stylifera* (KOWALEVSKY), a tropical species, resembles the present new species in the appearance of the stomach with slight plications, but the mushroom-like shape of the colony and the presence of the post-abdomen filled with the gonad separate the former distinctly from the latter.

*D. clavata* (SARS), an arctic species, differs also from the present species in the shape of its colony which assumes a characteristic club-like form.

## 2. *Ciona intestinalis* (LINNAEUS) 1767

Several individuals attached on shells of *Ostrea* and *Pinna*.

## 3. *Ascidia divisa* SLUITER 1898

(Fig. 2)

*Ascidia canaliculata* SLUITER (1885): Naturk. Tijdschr. Nederl. Ind., Vol. 45.
*Ascidia divisa* SLUITER (1898): Zool. Jahrb. Syst., Vol. 11; SLUITER (1904) Siboga-Exped. mon. 56 a; HARTMEYER (1906) Zool. Anz., Vol. 31.

Four specimens; the largest one measures 40 mm long×25 mm wide, while the smallest one is 28 mm in length, with dorso-ventral thickness 8-10 mm. Body oval, siphons indistinct. Branchial aperture terminal, atrial aperture situated slightly anterior to the middle of the body. Test cartilaginous and

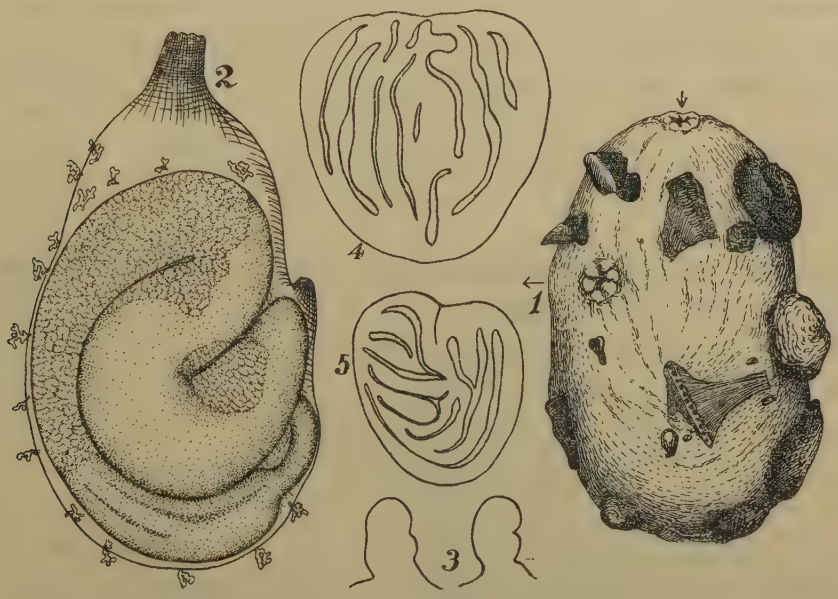


Fig. 2. *Ascidia divisa* SLUITER. 1–Right side of the entire animal; 2–Left side of the mantle body; 3–Papillae supporting the inner longitudinal vessels, ×75; 4 & 5—Ciliated grooves.

semitransparent; the surface irregularly wrinkled and furnished with some grits or shell fragments, showing that these specimens lying on a gritty bottom, with their left side below. Mantle yellowish brown, except the left side

which appears somewhat grayish-white on account of the alimentary canal showing through. Many minute vessels protrude out of the general contour of the mantle along its peripheral margin on its left side. Muscles restricted to the marginal portion on the right side only. Margin of branchial aperture divided into 7-8 lobes, that of the atrial aperture into 6 lobes; the lobes are pectinate in some individuals. Both siphonal tubes very short.

*Branchial sac:* Inner longitudinal vessels ca. 32, transverse vessels 100-140. Slight plications present. Four to five stigmata in a mesh. Margin of dorsal lamina with shallow and somewhat irregular notches; ribs present, but not protruding from the margin. Dorsal tubercle large; ciliated groove divided into numerous slits and has a complex configuration. Tentacles 40-60, excluding minute ones.

*Alimentary system:* The anterior margin of the intestinal loop reaches midway between the bases of both apertures. Line-$\alpha$ (axis of the second intestinal loop) reached beyond the pyloric end of the stomach.

*Remarks:* *Ascidia samea* OKA resembles the present species in the arrangement of the mantle muscles. But, the former shows much closer resemblance with *As. sydneiensis* STIMPSON in having rather simple ciliated groove. For the present, I am not certain of the identity of *As. divisa* to *As. sydneiensis*.

## 4. *Botryllus communis* OKA 1927.

(Fig. 3)

Many colonies attached to *Sargassum*. Test transparent, zooids purplish-brown in colour. System distinct.

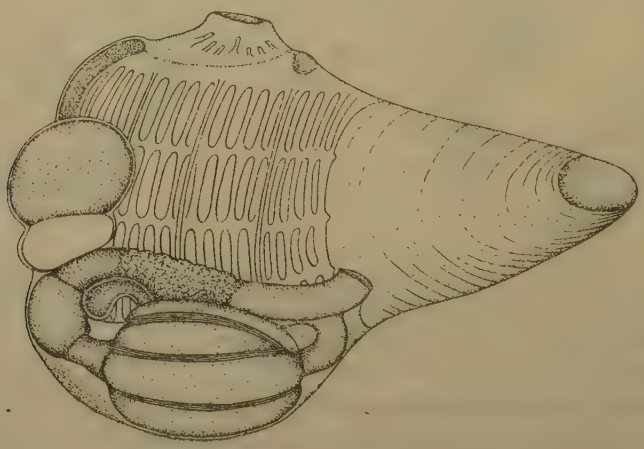

Fig. 3. *Botryllus communis* OKA. Zooid.

*Zooid*: Zooids nearly vertical and 1 mm in length. Stigmata arranged as: D 4 3-4 4-5 V. The anterior margin of the intestinal loop reaches the middle of the third stigmata row, or posterior to it. Stomach with 8 plications.

*Gonad*: Testis is an ovoid mass situated close to the ventral side on the 3rd stigmata-row on the left side, and on the 4th stigmata-row or posterior to that level on the right side. Ovary developes on the anterior side of the testis; often with a large mature ovum protruding out.

## 5. *Botrylloides violaceum* Oka 1927

Two small colonies 18×7 mm and 9×7 mm respectively in extent and both 2 mm in thickness, attached to a rock below the low-water mark, were found on March 24 1950 at Tannowa near Ozaki. Colour of zooids purplish-brown. Stomach with 9 plications.

## 6. *Symplegma reptans* (Oka) 1927

*cit.* Tokioka (1949): Publ, Seto Mar. Biol. Lab. Vol. 1, No. 2, pp. 49-51.

Many colonies incrusting *Sargassum*. A small colony covers the carapace of a Leucosiid crab partly. Atrial tentacles present?

*Branchial sac*: Six to seven stigmata rows on the dorsal side and 7-8 on the ventral side.

*Alimentary system*: The anterior end of the intestinal loop does not reach the middle of the body. Stomach with 9-10 plications. Pyloric coecum distinct.

*Larva*: 1.5 mm in length. Trunk 1/2.5-1/3 the length of tail, elongate oval in shape and with 3 distinct attachment processes. No ampulla in the anterior part of the trunk.

## 7. *Polyzoa pacifica* n. sp.

(Fig. 4.)

Many individuals attached on *Sargassum*. Body 3-4 mm in length, oval in shape, and considerably depressed dorso-ventrally. Each ascidian is attached by the ventral side and connected one another with creeping stolons. Branchial aperture subterminal, atrial aperture near the middle of the body; both apertures round. Test sandy gray and very strong. Mantle dark brownish and considerably thick. An elongate vesicle, probably the endocarp, is present near the centre of the inner surface of the mantle on each side.

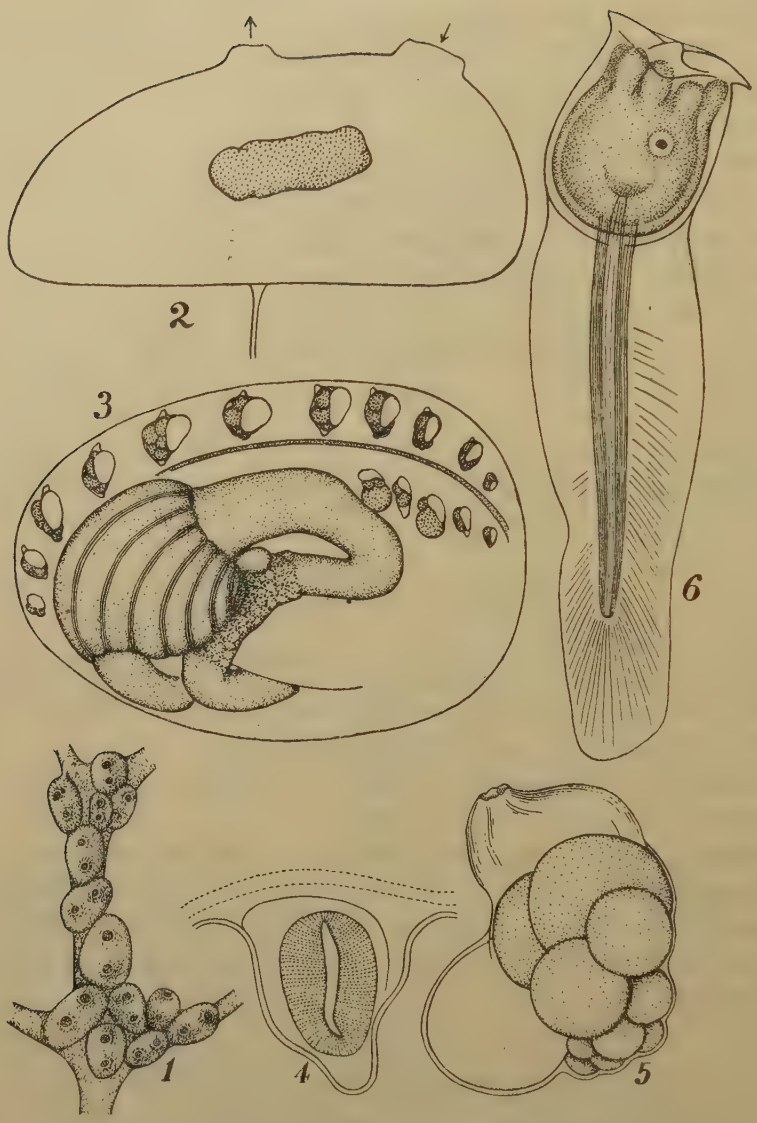


Fig. 4. *Polyzoa pacifica* n. sp. 1–Group of ascidians; 2–Right side of the mantle body; 3–Ventral side of the mantle body; 4–Ciliated Groove, ×75; 5 Gonad, ×75; 6–Larva, ×45.

*Branchial sac*: Stigmata rows 12, stigmata very long and bridged by parastigmatic vessel, showing the following arrangement between 3 longitudinal vessels in one specimen: D 8 7 8 13 V. Tentacles ca. 16. Ciliated groove a longitudinal slit.

*Alimentary system*: Alimentary canal occupies the ventral side of the

body. Stomach large, with 15 plications on the surface and a conspicuous coecum in the pyloric portion. The proximal portion of the intestine is slightly thicker than the distal portion. Anus plainly margined. Circum-intestinal gland distinct.

*Gonad*: Maximum numbers in the present material 5 on the left and 11 on the right side. Each gonad consists of a round testicular follicle and several ova. About 30 embryos in various stages of development found contained in the atrium of some zooids. Trunk of larva 0.6 mm in length and with 8 ampullae.

*Remarks*: This species closely resembles *P. vesiculiphora* TOKIOKA found in Akkesi Bay in Hokkaidô. The characteristics differentiating the former from the latter are: 1) the dorso-ventrally compressed appearance of the body and 2) the presence of more stigmata-rows (12 instead of 9-10) in the former.

## 8. *Styela partita* (STIMPSON) 1852

(Fig. 5; Pl. XI, Figs. 1-4)

Many small specimens attached on an oyster shell, of which the largest one measures 22 mm long×16 mm wide, while the smallest one is only 4 mm long×2 mm wide. Body roughly oval; branchial aperture terminal or subterminal, atrial aperture situated near it. Both apertures 4-lobed and not projected out strongly. Test thin and leathery, but strong, reddish-brown in many specimens, although it may be grayish with a yellowish orange or brownish tint near the apertures in some individuals. Inner surface of test grayish brown. Surface of test varies in appearance from nearly smooth to somewhat wrinkled. Test of smaller specimens usually divided into many small areas by irregularly arranged grooves. The region surrounding both apertures is strongly grooved in all specimens. Smaller specimens attached by their whole ventral side, while larger ones attached by the ventro-posterior side. Mantle yellowish white, with many endocarps on the inner surface, especially on the right side. Atrial tentacles absent.

*Branchial sac*: Number of inner longitudinal vessels:

(15 mm long individual)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| left | D | 1 | (13) | 4 | (13) | 4 | (14) | 4 | (10) | 3 | V. |
| right | D | 4 | (14) | 4 | (14) | 5 | (14) | 4 | (10) | 3 | V. |

(22 mm long individual)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| left | D | 5 | (15) | 10 | (12) | 9 | (11) | 11 | (ca. 5) | ? | V. |
| right | D | 8-9 | (8) | 8 | (11) | 9 | (12) | 8 | (5) | 6 | V. |

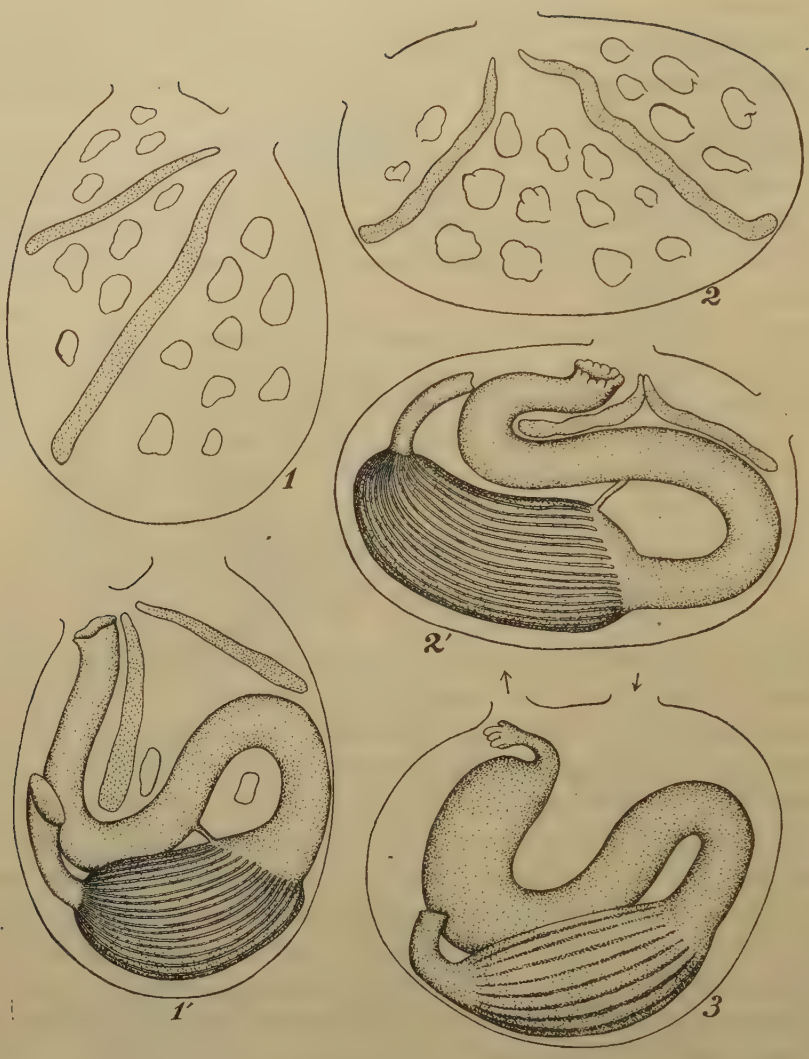


Fig. 5. *Stycla partita* (STIMPSON). 1,1'–22 mm long specimen; 1–Right half from inside; 1'–Left half from inside; 2,2'–15 mm long specimen; 2–Right half from inside; 2'–Left half from inside; 3–Left half from inside, 9 mm long specimen.

Parastigmatic vessel present. About 5 stigmata in a mesh. Tentacles 40-60, excluding minute ones; large and small ones alternate rather irregularly. Ciliated groove simple U-shaped. In many specimens the peribranchial cavity contains a number of parasitic copepods.

*Alimentary system*: In smaller individuals alimentary canal occupies nearly the whole left side. Oesophagus very short, stomach elongate, with 17-

18 plications on one side. Pyloric coecum absent. Intestine figures a S-like course. Anus lobated.

*Gonad*: Two long gonads on each side; the posterior one on the left side lies in the 2nd intestinal loop.

## 9. *Styela plicata* (Lesueur) 1823

Three specimens, 18-37 mm in length, attached to the substratum by posterior portion. Branchial aperture subterminal or terminal, atrial aperture situated near it. Colour of test varies from milky white to pale grayish brown. Test thick and irregularly grooved; and cartilaginous, although exceptionally it is rather hard. Apertures 4-lobed and marked each with 4 purplish brown-colour bands which rapidly fade towards the basal portion. Mantle fleshy orange in colour, with many endocarps on the inner surface.

*Branchial sac*: Inner longitudinal vessels as follows:

(37 mm long individual)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D | 3 | (13) | 6 | (15) | 5 | (15) | 5 | (11) | 4 V. |

(27 mm long individual)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| left | D | 3 | (15) | 4 | (13) | 4 | (14) | 3 | (10) | 3 V. |
| right | D | 3 | (13) | 4 | (14) | 4 | (15) | 4 | (10) | 3 V. |

Tentacles ca. 25, excluding minute ones. Ciliated groove C- or horse-shoe-shaped, with anterior ends curled in. Many parasitic copepods in the peribranchial cavity.

*Alimentary system and Gonad*: Oesophagus very long. Intestine with follicular appendages. Gonads 6-7 on the right and 2 on the left side. The left posterior gonad is surrounded by the 2nd intestinal loop. Testicular follicles roundish in immature individuals, but elongate in mature ones. Gonad undeveloped in 18 mm long individual.

## 10. *Styela plicata* forma *tenuis* n. f.

(Fig. 6)

One specimen, 49 mm long × 27 mm wide, is found in the material. Body oval, 31 mm long, with the thin posterior peduncular portion 18 mm in length. This specimen seems to be grown on the sandy bottom, since a mass of sand is attached to the end of the peduncle. Branchial aperture subterminal, atrial aperture situated near it. Test pale purplish-gray in colour and very thin, but tough. Surface rather smooth, with several faint grooves. Eight purplish-

Fig. 6. *Styela plicata* f. *tenuis* n. f. 1-Entire animal; 2-Left half from inside; 3-Right half from inside; 4-Ciliated groove; 5-Anus.

brown longitudinal bands run on the test and converge anteriorly to the apertures, 4 on each one. Mantle orange-brown, with many endocarps on the inner surface. Many parasitic copepods in the peribranchial cavity. Atrial velum present, but no atrial tentacles.

*Branchial sac*: Inner longitudinal vessels arranged as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| left | D | 9 | (10) | 13 | (17) | 9 | (16) | 8 (11) | 6 V. |
| right | D | 8 | (11) | 10 | (20) | 8 | (17) | 6 (13) | 5 V. |

Parastigmatic vessels present. Five to eight stigmata in a mesh. Tentacles 38, arranged roughly: large-small-medium-small-large. Ciliated groove U-shaped, with anterior horns strongly curled in.

*Alimentary system*: Oesophagus very long. Intestine with follicular appendages. Anus lobated.

*Gonad*: Seven gonads on the right, 2 on the left side, the left posterior gonad in the 2nd intestinal loop. Testicular follicles elongate.

*Remarks*: As the internal structure of the present specimen is exactly the same as that of *S. plicata*, I prefer to treat the specimen as a peculiar pedunculate form of *S. plicata*, which differs from the type in the presence of a distinct peduncle and in the thin and smooth appearance of the test. Of these characteristics, the latter seems to be more pronounced than the former.

## 11. *Styela isibasii* n. sp.

(Fig. 7; Pl. XI, Fig 5)

A specimen, 33 mm long×21 mm wide, attached to an oyster shell. Body oval, attached by the posterior end. Branchial aperture terminal, atrial aperture situated near it. Both apertures 4-lobed and hardly discernible. Test light greenish-brown and very hard, and giving the specimen an appearance resembling *S. plicata*. It is 2 mm thick in some portions. The inner surface coloured somewhat brownish. Mantle yellowish and muscular. Atrial tentacles absent. Endocarps found on the inner surface of the mantle. The peribranchial cavity harbours a parasitic (?) amphipod.

*Branchial sac*: Inner longitudinal vessels arranged as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| left | D | 7 | (20) | 6 | (21) | 9 | (24) | 7 (20) | 7 V. |
| right | D | 7 | (18) | 10 | (18) | 9 | (24) | 10 (20) | 5 V. |

Tentacles ca. 40. Ciliated groove U-shaped.

*Alimentary system*: Oesophagus long. Stomach with longitudinal plications. Intestine with follicular appendages. Anus lobated. Four endocarps in the intestinal loop.

Fig. 7. *Styela isibasii* n. sp. 1–Left half from inside; 2–Right half from inside.

*Gonad*: Three thick gonads on the right side, none on the left. Testicular follicles rather elongate and clustered in the middle part of each gonad.

## 12. *Styela clava* HERDMAN 1881

(Pl. XI, Figs. 6 & 6'.)

A large specimen, 110 mm in length including the peduncle, and two small young ones, 10 and 35 mm long respectively, attached to an oyster shell. Descriptions of these small specimens follow :—

Body elongate, attached by the posterior end. Both apertures terminal and 4-lobed. Peduncle hardly discernible. The anterior part around the apertures furnished with many whitish irregular prominences, the rest of the test leathery and longitudinally wrinkled, whitish-brown in colour and marked faintly with some reddish tint. Ciliated groove C-shaped. No specimen has developed gonad.

## 13. *Halocynthia roretzi* (DRASCHE) 1884

(Fig. 8)

A small immature individual, 30 mm long×17 mm wide, found on an oyster shell. As OKA (1935) describes the external appearance of an immature

individual, I wish to give here my observations on the internal structure of the present specimen, with illustrations.

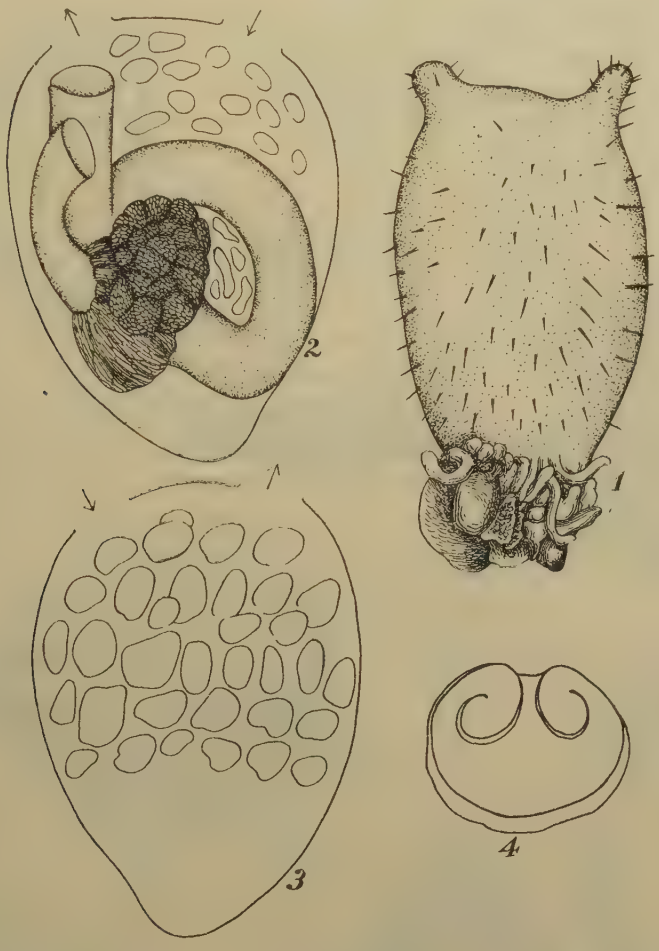


Fig. 8. *Halocynthia roretzi* (DRASCHE) juv. 1–Entire animal; 2–Left half from inside; 3–Right half from inside; 4–Ciliated groove.

Test reddish-orange and sparsely armed with spines which are shorter than 1 mm. Inner longitudinal vessels of the branchial sac arranged as follows:

left (13 folds)

D 0(2) 0(8) 0(19) 2(21) 3(25) 2(25) 3(23) 2(23) 3(18) 3(16)
1(15) 1(12) 0(3) 0 V.

right (13 folds)

D 0(5) 1(17) 2(22) 2(24) 2(23) 3(21) 2(23) 2(21) 2(18) 2(16) 1(15) 0(10) 1(3) 0-1 V.

Parastigmatic vessels present. Five to six stigmata in a mesh. Tentacles 15, excluding minute ones; branches in 2 orders, of which those of the 2nd order are very sparse. Ciliated groove U-shaped, with terminals strongly curled in. Liver yellowish. Intestine faintly purplish in colour. Anus plainly margined. Gonad not yet developed.

## 14. *Eugyra* sp. (?)

(Pl. XI, Fig. 7)

A small, 9 mm long, oval ascidian is found on an oyster shell. Test very soft, both apertures situated at the anterior end of the body. The inner side is mutilated, which makes the identification of the specimen very difficult. Very probably, however, the present specimen is a molgulid, belonging to the genus *Eugyra*, judging from the general appearance of the body which can hardly be assigned to any genus of other solitary ascidians.

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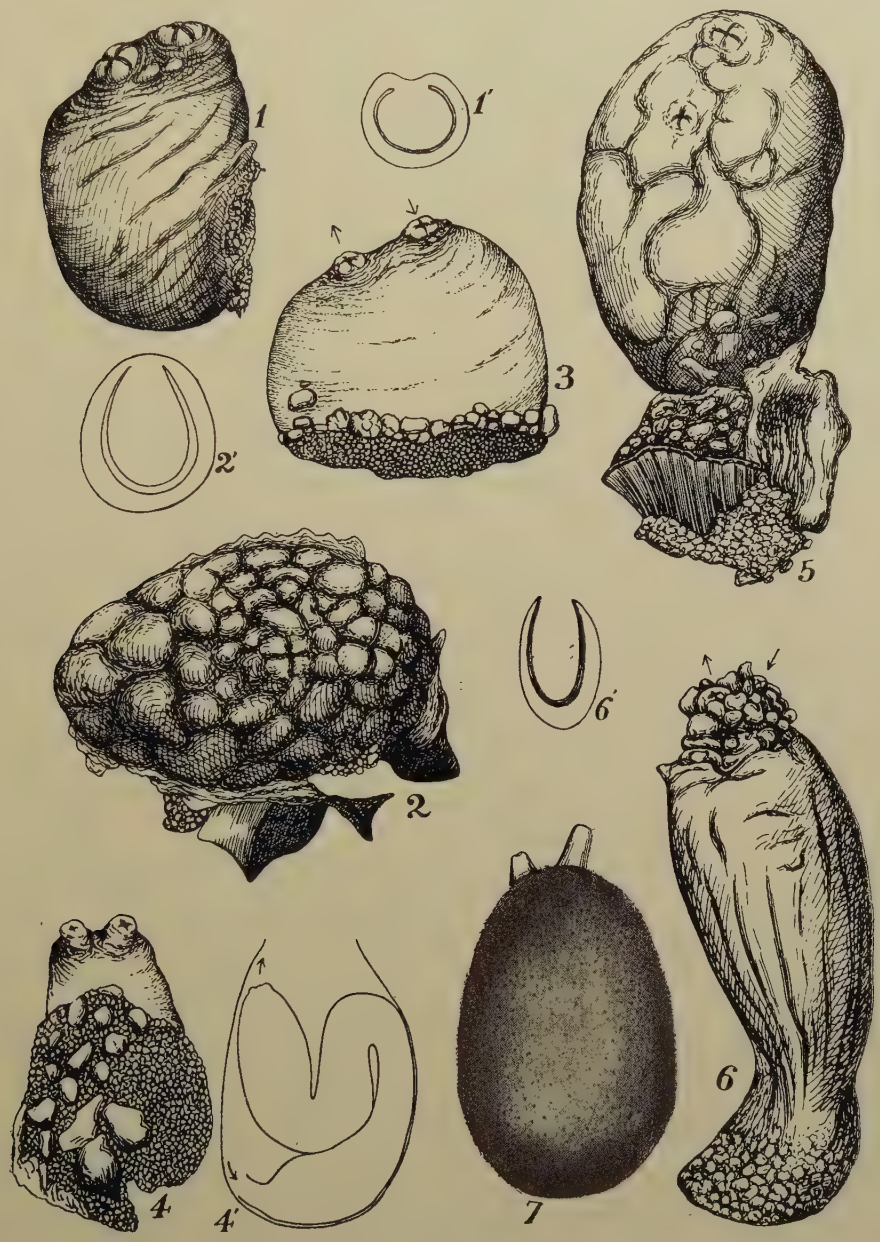
## EXPLANATION OF PLATE XI.

Fig. 1 . . . *Styela partita* (STIMPSON), Right side of the 22 mm long specimen.
Fig. 1' . . . „ „ „ , Ciliated groove of the 22 mm long specimen.
Fig. 2 . . . „ „ „ , Dorsal side of the 15 mm long specimen.
Fig. 2' . . . „ „ „ , Ciliated groove of the 15 mm long specimen.
Fig. 3 . . . „ „ „ , Right side of the 9 mm long specimen.
Fig. 4 . . . „ „ „ , 14 mm long specimen.
Fig. 4' . . . „ „ „ , Left half from inside, 14 mm long specimen.
Fig. 5 . . . *Styela isibasii* n. sp., Right side of the animal.
Fig. 6 . . . *Styela clava* HERDMAN, Right side of the 35 mm long specimen.
Fig. 6' . . . „ „ „ , Ciliated groove of the 35 mm long specimen.
Fig. 7 . . . *Eugyra* sp. (?).




T. Tokioka: Japanese Ascidian Fauna, IV

# DROPLETS FROM THE PLANKTON NET*

TAKASI TOKIOKA

## IX. Record of *Cyclosalpa bakeri* from Japanese waters

So far as I am aware, *Cyclosalpa bakeri* was reported from San Pedro of California, Luzon of the Philippine Islands, the East Indies, the south-east Australian region, the west coast of Africa from the Equator to the Cape of Good Hope, the S. W. of Ireland and the North of Scotland, of which San Pedro was the northern-most locality in the Pacific.

Recently, I received from Prof. S. MOTODA of the Hokkaidô University several specimens of the aggregated form of a cyclosalpa, which were collected in the Bay of Osyoro on the west coast of Hokkaidô on May 17, 1950. In spite of rather imperfect condition of preservation, I could easily identify them as *Cyclosalpa bakeri* RITTER, since they were provided with a pair of distinct protuberances in the posterior part of the body, a testis and another organ of problematic nature near the intestine.

Evidently this locality in Japan is the northern-most in the Pacific, although it does not reach the latitude of the North of Scotland in the Atlantic, which is, at present, the northern-most locality of this salpa in the world.

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APSTEIN (1906): Die Salpen der deutschen Südpolar-Expedition. Deutsche Südpol. Expedit., 1901-03, Vol. 9, Zool. 1. (*C. floridana*)

FRASER (1949): The Distribution of Thaliacea in Scottish Waters 1920 to 1939. Scottish Home Department Fisheries Division, Scientific Investigations 1949, No. 1.

IHLE (1910): Die Thaliaceen der Siboga-Expedition. Siboga-Expeditie, Monogr. 56 d.

THOMPSON (1948): Pelagic Tunicates of Australia. Melbourne.

METCALF (1918): The Salpidae: A taxonomic Study. Smithsonian Inst. U.S. Nat. Mus., Bull. 100, Vol. 2, part 2.

RITTER (1905): The Pelagic Tunicata of the San Diego Region excepting the Larvacea. Univ. Calif. Pebl. Zool., Vol. 2, part 3.

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* Contributions from the Seto Marine Biological Laboratory, No. 159.

## X. Record of *Creseis chierchiae* (BOAS) from the Palao Islands

(Fig. 10)

I found many specimens of *Creseis* in plankton samples hauled in 1940 in the lagoon of Korôru in the Palao Islands. As they have each distinct transverse striations on the shell, I identify them as *Creseis chierchiae* (BOAS). They measure less than 2.2 mm in length and are very slender in outline. They differ distinctly from *Hyalocylis* which is also transversely striated and is much thicker than *Creseis*. This pteropod was commonly found, and evenly distributed in the lagoon at the frequency of ca. 42%, while it was much rarer or completely absent in samples hauled from the oceanic waters around the Islands. This species was much commoner in the lagoon than *Cr. acicula* and *Cr. virgula*, which occurred sparsely at the frequency of 11-16%. These observations seem to show that *Cr. chierchiae* is an inhabitant of the coastal or lagoon waters in the tropical Pacific and Atlantic.

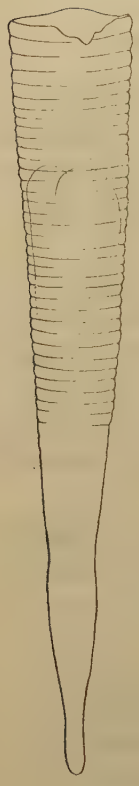

Fig. 10. *Creseis chierchiae* (BOAS) from Palao.

# PLANKTON INVESTIGATION IN INLET WATERS ALONG THE COAST OF JAPAN

## II. THE PLANKTON OF HAKODATE HAREOUR AND YOICHI INLET IN HOKKAIDO*

ISAMU YAMAZI

*With 3 Text-figures and 4 Tables*

The present paper deals with the result of surveys made in Hakodate Harbour on September 5, 1948 and in Yoichi Inlet on September 2. The methods of survey were the same with those described in my previous paper on three inlets of Hokkaido (Publ. Seto Mar. Biol. Lab., I (3) 1950).

During the field work I was helped by Mr. T. HABE and members of the Faculty of Fisheries of the Hokkaido University as well as the Hokkaido Fisheries Experimental Station. To all these gentlemen I wish to express my hearty thanks. I am also indebted to the Ministry of Education for some financial aid to this investigation.

### I. Plankton of Hakodate Harbour

Hakodate Harbour occupies the eastern part of Hakodate Bay, being bounded by three breakwaters. The harbour is the deepest in its middle part measuring ca. 13 m. It reaches about 20 m on the outside of the breakwaters. The hydrological results of the survey are summarized in Table 1. As to a more comprehensive oceanographical conditions of this harbour, the readers are referred to a report published by the Hakodate Marine Observatory (1945),[1] and a study of its shellfish-field made by TANITA, KATO and OKUDA (1950)[2].

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*Contributions from the Seto Marine Biological Laboratory, No. 160.

1) Hakodate Marine Observatory. 1950. The report of the oceanographical observation in the Hakodate Harbour. Jour. Oceanogr. H. M. O. No. 2.

2) TANITA, S., KATO, K., & T. OKUDA. 1950. Studies on the environmental conditions of shellfish-fields. I. In the case of Hakodate Harbour. Bull. Fac. Fish., Hokkaido Univ. vol. 1, no. 1, pp. 1—10.

## A. Quantitative Analysis of Plankton

The plankton was collected at 10 stations. It was much more abundant to the exterior of the harbour, especially in its northern part, than the inside,

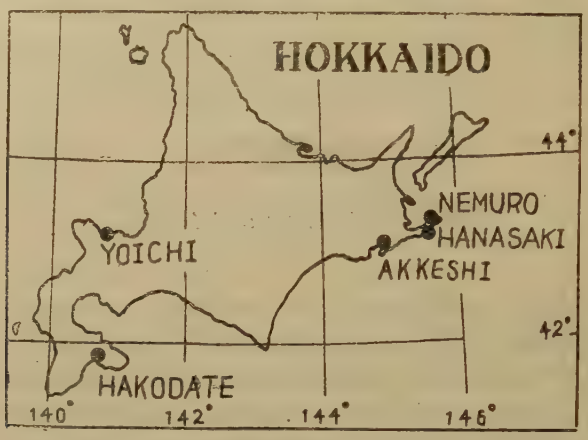


Fig. 1. Sketch map of Hokkaido, showing the Inlets which were surveyed.

Table 1. Hydrological conditions and some data on the plankton of Hakodate Harbour. N — total number of plankton per 10 L. For phytoplankton the unit is thousand.

| | Inside of the harbour | | | Outside of the harbour | |
|---|---|---|---|---|---|
| | Southern | Central | Northern | Northern | Southern |
| Water temperature (°C, surface) | 22 5 | 22.3 | 22.0 | 22.0 | 22.4 |
| Water color (FOREL's scale) | X | X | IX | IX | IX |
| Transparency (m) | 2.9 | 2.8 | 5.0 | 4.2 | 6.0 |
| pH value (surface) | 8.4 | 8.3 | 8.4 | 8.3 | — |
| Salinity (‰, surface) | 31.7 | 31.8 | — | — | 31.9 |
| Oxygen (cc/L, surface) | 4.5 | 5.4 | — | — | 6.3 |
| Oxygen (%, surface) | 86.4 | 103.2 | — | — | 119.0 |
| $P_2O_5$ (mg/m) | 28.3 | 19.8 | 17.6 | — | 14.4 |
| $SiO_2$ (mg/m) | 4100 | 3100 | 2800 | — | 1500 |
| Settling volume (cc/10 L) | 0.3 | 0.1 | 0.4 | 1.0 | 0.3 |
| Number of zoopl. per 10 L. (Z) | 302 | 227 | 364 | 554 | 108 |
| Percentage of zoopl. (Z/N×100) | 0.2 | 0.5 | 0 2 | 0.7 | 0.1 |
| Number of phytopl. per 10 L. | 133.1 | 46 2 | 199.5 | 211.5 | 89.2 |
| Percentage of phytopl. (P/N×100) | 99.8 | 99.5 | 99.8 | 99.3 | 99 9 |
| Number of zooplankton species | 16 | 15 | 17 | 17 | 16 |
| Number of phytoplankton species | 23 | 24 | 27 | 32 | 33 |

in the settling volume as well as the number of cells, individuals or colonies. As the phytoplankton formed the largest part of the plankton, the distribution of population density of the former and that of the settling volume of the total plankton had the same tendency, especially in the northern part of the area, where phytoplankton attained the maximum amount by about 200 thousands of cells or colonies per 10 L. The average cell or colony number throughout the whole area was 139 thousands per 10 L.

The zooplankton was more abundant in the northern half of both inside and outside of the breakwaters, where the count reached 30-500 individuals per 10 L. The southern part outside the harbour sustained the smallest amount. The size of zooplankton population was not parallel to the settling volume of the whole plankton. The numerical percentage of animals to the total plankton ($Z/N \times 100$) was less than 0.5; the largest value was found in the central part of the harbour, where the phytoplankton was relatively scarce.

### B. Qualitative Analysis of Plankton

As shown in Table 2 and Fig. 2, the most important component of zooplankton was Copepoda (82.6%), being followed by Protozoa (5.2%) Cladocera (1.6%), Copelata (0.8%), and Polychaeta larvae (9.8%). Copepods were found most abundantly in the northern part outside the harbour and represented chiefly by juveniles. *Paracalanus parvus*, *Oithona nana*, *Centropages abdominalis* and *Microsetella norvegica* appeared sparsely, among which the first one occurred rather frequently in the northern part outside the harbour. No oceanic copepod was represented in the present material.

Protozoans were represented by Tintinnoinea, and among the five species of which listed in Table 2, *Undulla* appeared only in the inmost part of the harbour, and *Tintinnopsis beroidea* and *Amphorella quadrilineata* occurred in a small quantity. *Synchaeta* sp., *Sagitta delicata* and *Oikopleura dioica* seemed to be more abundant in the harbour than its outside. Polychaeta larvae occurred abundantly in the northern part of the surveyed area (about 159/10 L in the harbour and 50/10 L outside the harbour), but were very rare in the southern part.

The diatoms were practically the only components of the phytoplankton of this harbour. Among diatoms *Chaetoceros* (68%) and *Asterionella* (29%) were the most important genera being followed by *Thalassiosira* (1%), *Rhizosolenia* (0.2%), *Bacteriastrum* (0.2%) and *Nitzschia* (0.3%). Such diatom genera as *Thalassiothrix* and *Biddulphia*, and Dinoflagellata were very sparse. Among *Chaetoceros*, *Ch. compressus* and *Ch. laciniosus* were the dominants, but *Ch. cruvisetus*, *Rh. Stolterfothii* and *Thalassiothrix Frauenfeldii* were scarce.

Table 2. Composition of plankton in Hakodate Harbour. The number of colony was counted in colony-forming species. Unit of number in phytoplankton is thousand.

| Region / Species | Inside of the harbour | | | | | | Outside of the harbour | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Southern part | | Central part | | Northern part | | Northern part | | Southern part | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Protozoa | **15** | **19** | **11** | **11** | **12** | **18** | **14** | **18** | **14** | **5** |
| *Helicostomella longa* | 2 | 2 | 4 | 3 | 8 | 13 | 6 | 4 | 6 | 2 |
| *Tintinnus tubulosus* | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 4 | — | — |
| *Codonellopsis morchella* | 4 | 8 | 3 | 1 | 2 | 4 | 5 | 9 | 8 | 3 |
| *Tintinnopsis mortensenii* | 1 | 2 | 2 | 1 | 1 | — | 1 | 1 | — | — |
| *Undulla californiensis* | 3 | 4 | — | — | — | — | — | — | — | — |
| *Favella taraikaensis* | — | — | — | 4 | — | — | — | — | — | — |
| *Synchaeta* sp. | **4** | **8** | 8 | **16** | **12** | **4** | **6** | **6** | **5** | — |
| Copepoda | **275** | **169** | **264** | **182** | **141** | **286** | **493** | **269** | **158** | **103** |
| *Acartia clausi* | 7 | 1 | — | — | 3 | 6 | 12 | 8 | 8 | 1 |
| *Oithona nana* | 6 | 5 | 19 | 11 | 8 | 5 | 8 | 1 | 3 | 2 |
| *Paracalanus parvus* | 1 | — | — | — | — | 13 | 30 | 20 | 12 | 10 |
| *Microsetella norvegica* | 1 | 3 | — | — | — | 2 | 3 | — | — | — |
| Copepoda juveniles | 260 | 187 | 245 | 171 | 130 | 260 | 440 | 240 | 135 | 90 |
| *Oikopleura dioica* | **2** | **2** | **2** | **4** | **3** | **6** | **3** | **3** | **2** | **1** |
| Polychaeta larvae | **8** | **9** | **19** | **23** | **159** | **50** | **38** | **5** | — | — |
| *Sagitta delicata* | — | — | — | — | — | — | — | — | **2** | **1** |
| Dinoflagellata | **33** | **192** | **363** | **356** | **263** | **489** | **399** | **249** | **118** | **27** |
| *Prorocentrum micans* | + | + | 7 | 7 | 20 | 12 | 11 | 3 | — | — |
| *Peridinium crassipes* | 1 | 2 | — | — | — | — | — | 4 | 7 | — |
| *Per. pellucidum* | 30 | 180 | 350 | 340 | 233 | 452 | 382 | 190 | 103 | 25 |
| *Per. oceanicum* var. *oblongum* | 2 | 8 | 4 | 8 | 10 | 25 | 6 | 41 | 8 | 2 |
| *Chaetoceros* | **62.6** | **71.3** | **43.1** | **25.8** | **34.7** | **119.1** | **183.5** | **136.7** | **121.1** | **60.9** |
| *Ch. compressus* | 7.6 | 6.7 | 2.3 | 1.7 | 1.4 | 2.9 | 4.5 | 4.3 | 5.9 | 2.3 |
| *Ch. decipiens* | 0.2 | 0.1 | 0.1 | + | + | 0.2 | 0.2 | 0.2 | 0.2 | 0.4 |
| *Ch. radicans* | 1.9 | 1.2 | 1.3 | 1.5 | 1.2 | 1.1 | 0.9 | 0.7 | 0.6 | 1.2 |
| *Ch. didymus* | 0.9 | 0.9 | 1.1 | 1.3 | 1.2 | 2.0 | 1.9 | 0.7 | 0.9 | 1.8 |
| *Ch. Lorenzianus* | + | + | + | + | + | 0.3 | 1.8 | 0.2 | 0.1 | 0.2 |
| *Ch. affinis* | 3.2 | 3.2 | 3.4 | 1.5 | 1.5 | 8.4 | 13.9 | 2.4 | 4.5 | 5.1 |
| *Ch. laciniosus* | 48.7 | 58.9 | 35.3 | 19.5 | 29.1 | 103.9 | 159.8 | 127.9 | 109.3 | 49.7 |
| *Ch. coarctatus* | + | 0.1 | + | + | + | + | 0.1 | + | + | 0.1 |
| *Bacteriastrum hyalinum* | **0.2** | **0.2** | **0.2** | **0.2** | **0.3** | **0.4** | **0.6** | **0.3** | **0.2** | **0.1** |
| *Nitzschia seriata* | **0.2** | **0.1** | **0.3** | **0.1** | **0.1** | **1.4** | **0.7** | **0.4** | **0.3** | **0.2** |
| *Thalassiosira hyalina* | **0.7** | **0.7** | **0.2** | **0.3** | **1.4** | **1.3** | **1.2** | **0.7** | **1.1** | **1.2** |
| *Thalassionema nitzschioides* | + | + | + | + | + | 0.1 | 0.3 | 0.1 | 0.1 | + |
| *Asterionella japonica* | **68.8** | **78.5** | **19.3** | **18.9** | **38.5** | **77.0** | **23.5** | **69.6** | **103.2** | **26.3** |
| *Rhizosolenia* | **0.4** | **0.1** | **0.2** | **0.2** | **0.1** | **0.3** | **1.1** | **0.3** | **0.2** | **0.2** |
| *Rh. alata* f. *genuina* | 0.1 | + | + | + | + | + | 0.3 | 0.1 | 0.1 | + |
| *Rh. hebetata* f. *semispina* | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.5 | 0.1 | + | + |
| *Rh. setigera* | — | — | + | + | + | 0.1 | 0.3 | + | + | + |
| *Rh. Stolterfothii* | + | + | + | + | + | + | + | + | + | + |

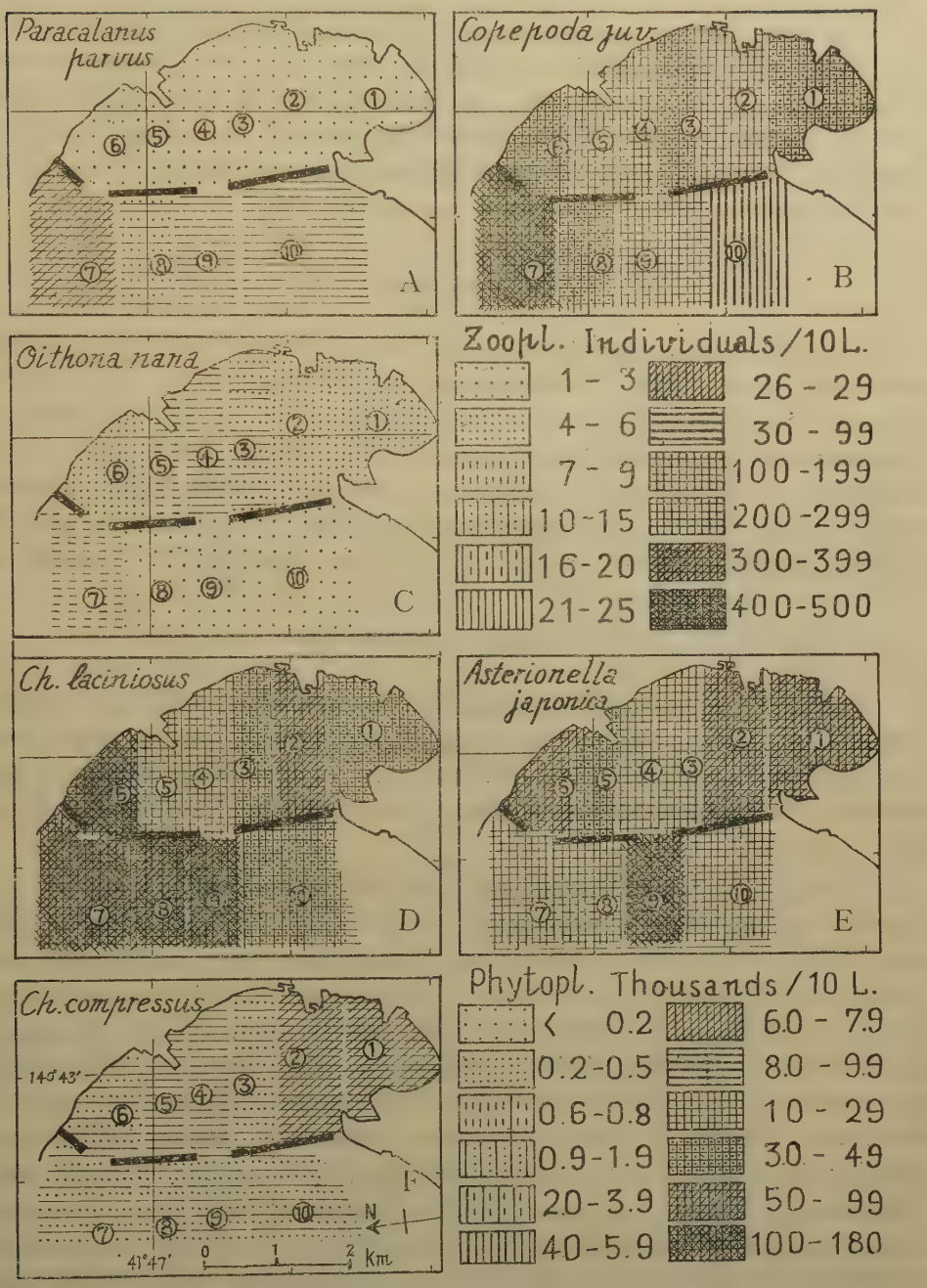


Fig. 2. Quantitative distribution of important species. A, B, C, Population of zooplankton (individuals/10 L). D, E, F, Population of diatoms (thousands/10 L.)

especially in the inmost part of the harbour. *Hemiaulus Hauckii*, *Hem. membranaceus*, *Rhizosolenia cylindrus* and *Leptocylindrus danicus* were found in very

small amounts only in the outside of the harbour. Dinoflagellates were represented chiefly by *Peridinium pellucidum*, which was more abundant in the harbour than the outside. Besides the species listed in Table 2, *Cer. tripos*, *Cer. trichoceros*, *Cer. fusus*, *Cer. furca*, *Cer. Kofoidii*, *Cer. Grande* and *Cer. intermedium* occurred very sparsely to the outside of the harbour, and some of these species were found in the open sea, too.

### C. Remarks

From the data given above, it may be said that the surveyed area was filled with three kinds of water-masses at the time of our observation, although the demarcations among them were not clear. They are first the harbour water characterized by the scarceness of species, the richness of *Ch. compressus* and *Oithona* and the scantiness of *Paracalanus*, second the bay water with abundant diatoms and *Paracalanus*, and third the water of somewhat open-sea nature having rich species in spite of the small quantity of plankton.

## II. Plankton of Yoichi Inlet

Yoichi Inlet lies on the southern coast of Otaru Bay, and is protected by a breakwater. The surface water temperature and the salinity were about 21°C and 33.49‰ respectively at the station near the pier and 22.6°C and 23.55‰ in the inner part, where a small river flows in. Ph-value was 8.2 at both stations.

The results of quantitative and qualitative analysis of the plankton collected at two stations are summarized in Table 3. By comparing this table with Table 2, the differences of plankton constitution between this inlet and Hakodate Harbour may become clear. The absence of *Helicostomella* (Tintinnoinea) which is an inhabitant of the inner part of inlet, and the occurrence of such species as *Oithona similis*, *Coricaeus* sp., *Oncaea venusta* and *Pseudocalanus elongatus* even at the inmost station are the characteristics of Yoichi Inlet. The water of Hakodate Harbour is much polluted by sewage from its surrounding city, although it maintains a moderately high salinity. Diatoms seem to be unable to keep their prosperity in this strongly polluted water, but attain a mass development along the margin of the turbid water outside of the harbour. In Yoichi Inlet the settling volume of plankton was slightly larger at the inner station than the pier station. This fact and the richness of species, including some species of the open water, seem to show the low degree of pollution and at the same time the strong influx of oceanic water into this inlet.

Table 3. Composition of plankton in Yoichi Harbour. N — total number of plankton per 10 L.
Unit of number in diatoms is thousand.

| | Pier region | | Inmost region | |
|---|---|---|---|---|
| Settling volume (cc/10 L) | 0.82 | | 0.88 | |
| Number of zooplankton per 10 L (Z) | 587 | | 801 | |
| Percentage of zooplankton (Z/N×100) | 0.4 | | 1.0 | |
| Number of phytoplankton per 10 L (P) | 159,062 | | 73,380 | |
| Percentage of phytopl. (P/N×100) | 99.6 | | 98.9 | |
| Number of zoopl. species | 26 | | 24 | |
| Number of phytopl. species | 30 | | 26 | |
| Composition of zooplankton | N | % | N | % |
| Protozoa | **15** | **2.5** | **15** | **1.5** |
| *Tintinnus tubulosus* | 7 | 46.7 | 7 | 46.7 |
| *Codonellopsis morchella* | 4 | 26.7 | 3 | 20.0 |
| *Amphollela quadrineata* | 2 | 13.3 | 2 | 13.3 |
| *Undulla californiensis* | 2 | 13.3 | 3 | 20.0 |
| *Synchaeta* sp. | **1** | **0.2** | **2** | **0.3** |
| Copepoda | **525** | **89.4** | **739** | **92.3** |
| *Acartia clausi* | 5 | 1.0 | 6 | 0.8 |
| *Oithona similis* | 13 | 2.5 | 19 | 2.8 |
| *Oithona nana* | 8 | 1.5 | 15 | 2.2 |
| *Oncaea venusta* | 33 | 6.3 | 11 | 1.5 |
| *Paracalanus parvus* | 12 | 2.3 | 8 | 1.1 |
| *Pseudocalanus elongatus* | 4 | 0.8 | 2 | 0.4 |
| *Microsetella norvegica* | 4 | 0.8 | — | — |
| Copepoda juv. | 446 | 84.8 | 678 | 91.6 |
| *Sagitta delicata* | **1** | **0.2** | **1** | **0.2** |
| *Oikopleura dioica* | **2** | **0.4** | **1** | **0.2** |
| Larvae | **43** | **7.3** | **44** | **5.1** |
| Polychaeta larva | 6 | 14.0 | 18 | 41.9 |
| Pelecypoda larva | 2 | 4.6 | 8 | 18.6 |
| Ophiopluteus larva | 35 | 81.4 | 17 | 39.5 |

| Composition of phytoplankton | Pier region | | Inmost region | |
|---|---|---|---|---|
| | N | % | N | % |
| Dinoflagellata | **45** | **0.02** | **73** | **0.09** |
| *Prorocentrum micans* | 2 | 4.4 | 4 | 5.4 |
| *Ceratium tripos* | 3 | 6.7 | 6 | 8.2 |
| *Cer. trichoceros* | 4 | 8.9 | 4 | 5.5 |
| *Cer. massiliense* | 7 | 15.6 | 5 | 6.8 |
| *Cer. fusus* | 2 | 4.4 | 4 | 5.4 |
| *Peridinium crassipes* | 2 | 4.4 | 3 | 4.2 |
| *Per. pellucidum* | 23 | 51.2 | 38 | 52.1 |
| *Per. oceanicum* var. *oblongum* | 2 | 4.4 | 9 | 12.3 |
| *Chaetoceros* | **158.3** | **99.45** | **72.8** | **99.15** |
| *Ch. compressus* | 18.8 | 12 | 11.3 | 15 |
| *Ch. radicans* | 56.4 | 36 | 12.4 | 17 |
| *Ch. didymus* | 10.5 | 7 | 11.0 | 15 |
| *Ch. affinis* | 3.3 | 2 | 4.6 | 6 |
| *Ch. criophilus* | 0.9 | 1 | 1.8 | 3 |
| *Ch. laciniosus* | 67.4 | 42 | 31.3 | 43 |
| *Ch. peruvianus* | 0.4 | + | — | — |
| *Ch. coarctatus* | 0.4 | + | 0.3 | + |
| *Bacteriastrum hyalinum* | **0.2** | **0.1** | **0.2** | **0.1** |
| *Biddulphia reticulata* | + | + | + | + |
| *Nitzschia seriata* | + | + | + | + |
| *Rhizosolenia* | **0.5** | **0.34** | **0.3** | **0.48** |
| *Rh. alta* f. *genuina* | + | + | + | + |
| *Rh. hebetata* | 0.4 | 85 | 0.3 | 6 |
| *Rh. Bergonii* | 0.03 | 6 | 0.03 | 6 |
| *Rh. setigera* | 0.04 | 7 | + | + |
| *Rn. Stolterfothii* | + | + | + | + |
| *Climacodium biconcavum* | + | + | + | + |
| *Skeletonema costatum* | + | + | + | + |
| *Dactyliosolen antarcticus* | + | + | — | — |
| *Hemiaulus membranaceus* | + | + | — | — |

### III. General view on the planktons of 5 inlets in Hokkaido

The waters of Akkeshi, Hanasaki and Nemuro (YAMAZI, 1950) are affected by the cold Oyashio current flowing southwards along the Kurile Islands. Akkeshi Bay receives the inflow of many rivers draining the moorland, and its north-western part is filled with the water of yellowish brown colour, of small transparency and of low salinity. Inlets of Hanasaki and Nemuro face directly to the open sea and are not polluted in any high degree. The bays of Hakodate and Otaru are on the other hand affected by the warm Tsushima current which is a branch of the Kuroshio. Hakodate Harbour seems to maintain a relatively stagnant polluted water mass, whereas Yoichi Inlet is strongly influenced by the oceanic inflow. The dominant constituents of the plankton were somewhat similar in these five inlets despite of the differences in their oceanographical environments. For examples, *Chaetoceros laciniosus*, *Ch. com-*

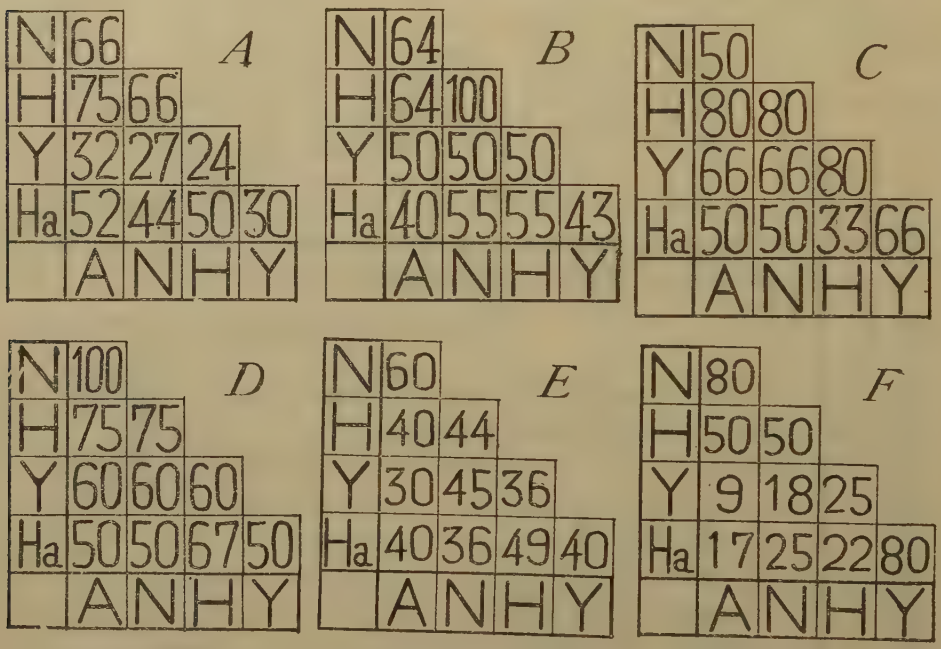


Fig. 3. Degree of similarity (S) in plankton compositions among five inlets.

$$S=\frac{c}{a+b+c}\times 100$$

a...number of species occurring only at St. A, b...number of species occurring only at St. B, c...number of species occurring at both Sts. A and B.

*A*. All diatoms. *B*. Diatoms occupying more than 1% of total plankton. *C*. Diatoms occupying more than 5% of total plankton. *D*. All Dinoflagellates. *E*. All zooplankton. *F*. All Tintinnoinea.

A.....Akkeshi; N.....Nemuro; H.....Hanasaki; Y.....Yoichi; Ha.....Hakodate

*pressus*, *Ch. radicans*, *Ch. didymus*, *Ch. alata* f. *genuina*, *Rhizosolenia hebetata* f. *semispina*, *Rh. setigera* and *Bacteriastrum* occurred in all inlets. There were, however, differences in the manner of occurrence of some species as shown in Table 4. The most remarkable case is seen in *Asterionella japonica* which was very abundant in all inlets except Yoichi.

Table 4. Distribution of main diatom species in five inlets.

| Species of diatoms | Nemuro | Hanasaki | Akkeshi | Hakodate | Yoichi |
|---|---|---|---|---|---|
| A. Cold water species | | | | | |
| *Rhizosolenia Faeröensis* | + | + | + | — | — |
| *Chaetoceros decipiens* | + | + | + | — | — |
| *Thalassiosira hyalina* | — | + | + | + | — |
| *Biddulphia aurita* | — | — | + | — | — |
| *Coscinodiscus Janischii* | + | — | — | — | — |
| B. Warm water species | | | | | |
| *Asterionella japonica* | + | + | + | + | — |
| *Chaetoceros Lorenzianus* | — | — | + | + | — |
| *Ch. coarctatus* | — | — | — | + | + |
| *Ch. pervianus* | — | — | — | — | + |
| *Climacodium biconcavum* | — | — | + | — | + |
| *Hemiaulus Hauckii* | — | + | + | — | — |
| *Hem. membranaceus* | — | — | — | — | + |
| *Ditylum Brightwellii* | — | + | + | — | — |
| *Bererochea malleus* | + | — | — | — | — |
| *Rhizosolenia Bergonii* | — | — | — | — | + |
| *Rh. cylindrus* | — | — | — | + | + |
| C. Ubiquitous species | | | | | |
| *Skeletonema costatum* | + | + | + | — | + |
| *Dactyliosolen mediterraneus* | — | — | + | — | — |
| *Rhizosolenia Stolterfothii* | — | — | — | + | + |
| *Nitzschia seriata* | — | + | + | + | + |
| *Nitz. longissima* | + | + | + | — | — |
| *Thalassiothrix Frauenfeldii* | — | — | + | + | — |

An attempt to see the degree of similarity of the plankton communities of these five localities was made in Fig. 3, which shows the percentage of species in common to different inlets. Some notable facts deduced from this figure are: (1) Hakodate Harbour differs from other 4 inlets in the occurrence of diatom species, being more numerous in the former than in the latter, although they resemble those of Yoichi Inlet most closely. (2) Yoichi Inlet

differs from other inlets in that its diatoms are poor in population and of the open-sea origin. (3) Diatom as well as dinoflagellate florae of Nemuro, Hanasaki and Akkeshi Inlets resemble closely to one another (Fig. 3A, B, D). (4) As to the Tintinnoinean fauna, Hakodate Harbour is related to Yoichi Inlet most closely, and Nemuro, Hanasaki and Akkeshi Inlets have similar constitution (Fig. 3, F.) (5) From these facts, it may be said that the plankton composition as a whole has similarities among Nemuro, Hanasaki and Akkeshi Inlets on the one hand, and Hakodate Harbour and Yoichi Inlet on the other. But the similarities are closer among the former three inlets than between the latter two.

In general both the quantity and the species of plankton decrease toward the inner part of the inlet, where the water is polluted and highly stagnant. The vigorous propagation of plankton occurs in regions where the polluted or stagnant water mixes with open sea water. So far as my collections concern the chief inhabitants in the inner part of the inlets in Hokkaido were some tintinnoineans, rotifers such as *Synchaeta* sp. and *Notholca bifurca*, *Peridinium pellucidum*, *Oithona nana*, *Paracalanus parvus*, *Acartia clausi* and copepod juveniles.

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ERRATUM

YAMAZI, I. 1950. Plankton investigation in inlet waters along the coast of Japan. I. (This journal, vol. 1, no. 3.)

Page 106: Line 9, *for* Qualitative *read* Quantitative.

# ANALYTICAL STUDIES ON MARINE LAMP-COMMUNITIES*

Hiroshi MAÉDA

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*With 7 Text-figures and 4 Tables*

## Introduction

From remote times, Japanese have used light for fishing at night. The torch was the only source of light till the middle of the Meiji era, when the petroleum lamp took its place, then appeared the Acethylen lamp and lastly the electric lamp connected to the battery or the dynamo. These lamps are now called "the fish gathering lamps", and they are indispensable in various districts for fishing sardines, scombers, Carangid fishes etc.

The scientific investigations have been made since 1926 on many such problems as the economic relations and the technique of the lamp fishery, the physical relations between the light and the water, or the reactions of some fishes to light. There is, however, no synecological investigation on the fish community formed under the lamp. It is obvious that the formation and the maintenance of the community under the lamp is controlled not only by phototaxis, but also by complicated coactions among the gathered fishes, of which the food relation seems to be the most significant factor.

In order to learn the food relations and their significance in determining the situation of each component fish in the community under the lamp, I planned a series of observations under the direction of Prof. D. Miyadi and Dr. T. Tokioka. I was helped much during the work by many fishermen with their vigorous labour as well as their useful suggestions. To all these gentlemen I express here my hearty thanks. I must also record my thanks for the financial aid given by the Hattori-Hôkôkai.

## Methods

The observations were made during the period from August to November of 1950, on board of small fishing boats professionally working near the Seto

* Contributions from the Seto Marine Biological Laboratory, No. 161.

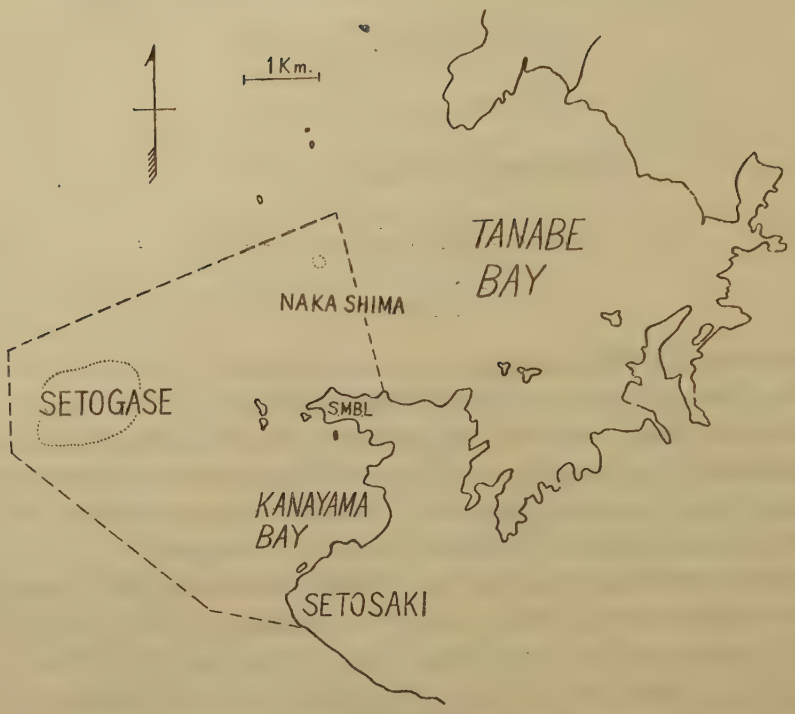



Fig. 1. Sketch map of the observation field.
S.M.B.L.—Seto Marine Biological Laboratory.

Marine Biological Laboratory (Fig. 1), which is situated on the west coast of the Kii Peninsula. The sea arcund the Laboratory is strongly influenced by a branch of the warm "Kuroshio" current. The depth of the sea reaches 10—20 m.

The light sources were 30—100 C.P. electric lamps, which were used either being immersed in the water or above it.

The food samples, *i.e.* stomach contents, were collected from the catches hauled during my observations.

## Lamp Animals and Lamp Communities

I propose to use the terms "lamp animals" and "lamp community" in the same sense as "torch plankton", *i.e.* the animals and their assemblage under the lamp. Among lamp animals, the pelagic fishes of the surface layer are the most important members, next come the middle layer fishes like *Parapristipoma trilineatum* (THUNBERG) and *Pempheris macrolepidotus* (BLOCH & SCHNEIDER), and lastly the benthonic fishes, which play insignificant rôle among

the lamp community although quite rich in the number of species. The presence of the benthonic fishes under the lamp is verifiable only by angling.

The lamp animals observed during my study were:—

(1) Plankton

Polychaeta

Copepoda

*Calanus* spp.

*Oncaea venusta*

Ostracoda

*Pyrocypris* sp.

*Cypridina hilgendorfii*

Cumacea

Mysidacea

*Siriella watasei**

*Tenagomysis orientalis*

Stomatopoda
Larvae

Amphipoda

Gammarid amphipods*

Hyperiid amphipods

Isopoda

Macrura

Puerulus

Natantians

Brachyura

Megalopae*

(2) Mollusca

*Ommastrephes sloani pacificus* Steenstrup

*Doryteuthis kensaki* (Wakiya & Ishikawa)

*Octopus variabilis* Sasaki

(3) Pisces

About 45% of the food fishes inhabiting in the vicinity of Seto are said to gather under the lamp.

a) Regular members (gathered under the lamp at the frequency more than 60% of my observations).

*Etrumeus micropus* (T. & S.)

*Amblygaster melanostricta* (T. & S.)

*Engraulis japonica* T. & S.

*Stolephorus japonicus* (Houttuyn)

*Harengula zunasi* Bleeker

*Cypselurus agoo* (T. & S.)

*Sphyraena japonica* C. & V.

*Atherina bleekeri* Günther

*Tylosurus anastomella* (C. & V.)

*Decapterus muroadsi* (T. & S.)

*Trachurus trachurus* (Linné)

*Trachurops crumenophthalmus* (Bloch)

*Pempheris macrolepidotus*
(Bloch & Schneider)

*Parapristipoma trilineatum*
(Thunberg)

b) Frequent visitors (gathered at the frequency of 45~60%).

* shows the quantitatively important animal.

*Scoliodon walbeehmi* (BLEEKER)
*Dorosoma thrissa* (LINNÉ)
*Hemirhamphus sajori* (T. & S.)
*Gymnothorax kidako* (T. & S.)
*Scomber scombrus japonicus* (HOUTTUYN)
*Scomber scombrus tapeinocephalus* (BLEEKER)
*Auxis thazard* (LACÉPÈDE)
*Auxis tapeinosoma* (BLEEKER)
*Euthynnus yaito* KISHINOUYE
*Trichiurus haumeal* (FORSKÅL)
*Caranx mertensi* C. & V.
*Apogon semilineatus* T. & S.
*Epinephelus moara moara* (T. & S.)
*Scombrops boops* (HOUTTUYN)
*Priacanthus hamrur* (FORSKÅL)
*Lutianus vitta* (QUOY & GAIMARD)
*Scolopsis nagasakiensis* (TANAKA)
*Gymnocranius griseus* (T. & S.)
*Lethrinus haematopterus* T. & S.
*Pagrosomus major* (T. & S.)
*Teuthis fuscescens* (HOUTTUYN)
*Sphoeroides spadiceus* (RICHARDSON)
*Sphoeroides vermicularis* (T. & S.)
*Sphoeriodes inermis* (T. & S.)

c) Occasional visitors (gathered at the frequency less than 45%. This column is composed of members which were observed by myself and those recommended by Mr. T. KANAYA, a skillful fisherman in the vicinity).

*Isurus glaucus* (MÜLLER & HENLE)
*Holocentrus ruber* (FORSKÅL)
*Sarda chilensis* (C. & V.)
*Caranx sexfasciatus* QUOY & GAIMARD
*Kyphosus cinerascens* (FORSKÅL)
*Ostracion diaphanum* BLOCH & SCHNEIDER
*Ostracion tuberculatum* LINNÉ
*Coryphaena hippurus* LINNÉ
*Lutianus fulviflamma* (FORSKÅL)
*Therapon oxyrhynchus* T. & S.
*Girella punctata* GRAY
*Sebastiscus marmoratus* (C. & V.)
*Areliscus joyneri* (GÜNTHER)
*Areliscus purpureomaculatus* (REGAN)

4) Mammalia

A certain species of dolphin, probably *Dolphinus*.

**Food Ranks of Main Lamp Fishes**

The stomach contents of the main lamp fishes collected during my observations are shown in Table 1. From this table and referring to my actual observations on the boat as well as the suggestions given by Messrs. K. ŌE and S. WADA, the lamp animals may be classified into the following eight groups.

1) Prey Group.

This group represents the lowest class in the food chain in this temporal community formed artificially. There is no producer or smaller prey nourishing group. This group consists of planktonic animals and *Engraulis* of "Shirasu" stage which are eaten chiefly by secondary predators, although a part of them

Table 1. Stomach contents of main lamp fishes.

| Fishes \ Stomach contents | *Stolephorus* | *Engraulis* of Shirasu stage | Megalopae | Natantians | Amphipods | Mysidaceans | Copepods | Other Crustaceans | Polychaetes |
|---|---|---|---|---|---|---|---|---|---|
| *Stolephorus* | | | | | | | R M | | |
| *Engraulis* | | C A | + M | | R S | R S | R S | R S | |
| *Pempheris* | | R A | C M | + S | C A | C A | | + S | R S |
| Carangidae | R S | C M | + M | R S | C A | R S | | R S | R S |
| *Sphyraena* | C A | R A | | | | | | | |
| *Trichiurus* | C A | R S | R S | R S | | | | R S | |
| *Atherina* | | R S | | | | + S | R M | R S | |
| *Cypselurus* | | | | | | | | | |
| *Teuthis* | | | | | | | | | |
| Tetraodontidae | R S | | | R S | | | | | |
| *Euthynnus* | | | | | | | | | |

Frequency Quantity

C: common A: abundant
+: medium M: medium
R: rare S: scarse

serves as the food of primary predators.

2) Primary Predators.

Fishermen classify the lamp fishes into two groups, one consisting of prey fishes and the other comprising predators. The former is commonly called "Komono" (*ko*=small, *mono*=things) : *e.g.* Clupeid fishes and *Pempheris*.

The primary predators, proposed here, consist chiefly of "komono", namely *Stolephorus*, *Engraulis* and *Pempheris*, of which the last one has the characteristics between the primary and secondary predators.

3) Secondary Predators.

This group and the primary predators are the main objects of lamp-fishery using a net. The members of this group feed chiefly on the prey group and occasionally on the primary predators.

This group consists of medium- or large-sized plankton-feeders, *e.g.* Carangids and Scombrids.

4) Tertiary Predators.

Fishermen call the predators belonging to classes higher than the tertiary as a whole, "Oi-mono" (*oi* means to disperse), and hate their visit to the lamp very much, because by those fishes are dispersed the secondary and primary predators which are the chief objects of the fishery. Fishes belonging to the tertiary predators feed mainly on the primary predators and occasionally on the secondary predators, but scarcely on the prey group.

*Sphyraena* and molluscan Decapods are the important members of this class. The former is, however, eaten by the latter, consequently the latter may be said to occupy the higher situation than the former.

5) Quarternary Predators.

This group feeds mainly on the primary, secondary, and the tertiary predators. The dispersing influence of fishes in this class is not so strong as that of the end predators, although it is much stronger than that of the tertiary predators.

6) End Predators (Community destroyers.)

This group occupies the highest position in the food-pyramid and may be called the destroyers of the community formed under the lamp, since the fishes vanish completely at the appearance of the members of this group. *Squalus*, *Coryphaena* and *Dolphinus* are members of this group in the upper layer of the water; the latter two are much rarer than the first. *Epinephelus* is a benthonic member of this group; its destroying activity is not strong.

7) Benthonic Group.

The food relations and consequently the food order of the benthonic fishes are not made clear.

8) Indifferent Fishes.

In this category are included many fishes which assemble under the lamp, but each has no significant relation to other fishes on account of the fewness, the short staying time or the fact that it seldom eats under the lamp. Some of these fishes state between the lamp fishes and those not gathered by the light. Following is the list of members of this group classified according to their habits in the day time.

a) Prey Group.

Benthonic crustaceans and jelly fishes.

b) Primary Predators.

*Atherina, Cypselurus,* and *Mugil.*

c) Secondary Predators.

*Ophichthus* and *Euthynnus.*

d) Tertiary Predators.

*Tylosurus.*

e) Benthonic Groups.

*Teuthis* and *Ostracion.*

**Situation of a Fish in the Same Food Rank**

The situation of a member fish in a certain food rank may be determined on following standards, which were derived chiefly from food relations.

1. The size of a lower rank is, in general, smaller than that of the higher rank. The fish of the young stage belongs to the lower rank than that of its full-grown stage.

2. The situation of a predator within the same food rank is roughly proportional to the order of the prey fish eaten by it.

3. The fish of lower food rank usually occupies the nearer position to the light source among the lamp community.

4. The fish of lower food rank is controlled more strongly by the light.

5. The fish with stronger dispersing influence on the community is placed in higher rank.

The smaller planktonic crustaceans serve as food merely for the primary predators. The larger planktonic crustaceans and *Engraulis* of the Shirasu stage are eaten by predators of 1st to 4th ranks. But the behavior of the latter resembles rather to primary predators than to that of prey groups.

*Stolephorus* and *Engraulis* form a single common shoal when they are not sufficiently numerous to form separate shoals. There is no direct food relation between *Stolephorus* and *Engraulis.* The former feeds absolutely on smaller planktonic crustaceans, especially *Oncaea venusta,* while the latter on larger planktonic crustaceans and Shirasu. Consequently, *Engraulis* may be placed in the higher position in a food chain than *Stolephorus.*

The plankton feeders under the lamp usually form a compact group, which swims around the light at a constant distance from it. They take the food actively under the lamp. *Atherina* and *Cypselurus* differ considerably in their behaviors under the lamp They dash to the light and then swim away from there. They take little food under the lamp. These peculiarities are much more conspicuous in *Cypselurus* than in *Atherina. Mugil* also shows such a

peculiarity as *Cypselurus* but more conspicuously. From these observations, it may safely be said that in the primary predator, the lamp fishes do not form a discontinuous group, but are connected with those not assembling to the light through the intermediate forms such as *Atherina—Cypselurus—Mugil.*

Although *Pempheris* and Carangid fishes form a common shoal when they are few, they form distinctly separated groups when they are numerous. They resemble with each other very closely in the behavior under the lamp. Once I tested the behavior of some lamp fishes enclosed in a net by changing the distance of light from the net, when *Engraulis* exhibited a strong photo-positive movement, while *Pempheris* and Carangids were quite indifferent. Carangid fishes belong to the secondary predators and feed on planktonic crustaceans as well as Shirasu and small-sized Clupeid fishes. *Pempheris*, on the contrary never eats the Clupeid fishes, although it takes the food much more than the common primary predators. From these reasons, I prefer to treat *Pempheris* as a primary predator placing it at the highest position in that rank.

Carangid fishes form very stable groups under the lamp, if there is a few prey. Scombrid fishes need much preys to keep their group near the lamp. Fishermen use "maki-e" in this purpose; here "maki" means "to throw" and "e" indicates the food. *Euthynnus* is very unstable under the lamp, it swims away from a lamp to another very frequently, and even the "maki-e" of Shirasu can not retain them under a same lamp. It seldom takes preys under the lamp as in *Cypselurus* and *Mugil.* Thus, the secondary predators in the lamp fishes are continuous to the fishes not assembling to the light through the route—Carangids—Scombrids—*Euthynnus*—, as in the case of the primary predators.

*Sphyraena* and molluscan Decapods must be the tertiary predators, because they eat Carangid fishes. Notwithstanding the fact that *Sphyraena* eats Carangids, the latter does not avoid the former. Decapods feed on Carangids and *Sphyraena* under the lamp. In this case, Carangids disperse and avoid Decapods, while *Sphyraena* does not avoid the squids. Thus, these three fishes may de arranged in the following orders:—Carangids—*Sphyraena*—molluscan Decapods.

The appearance of *Trichiurus*, *Epinephelus*, *Squalus*, *Coryphaena* and *Dolphinus* causes the complete dispersion of the fish group formed under the lamp. They are very few in number and visit the lamp only rarely. It seldom occurs that two or more species of them appear at the same time. Therefore, the food relation between them is quite obscure. The commonest one is *Trichiurus*, which is sometimes eaten by *Epinephelus*. *Epinephelus*, on the other hand, is

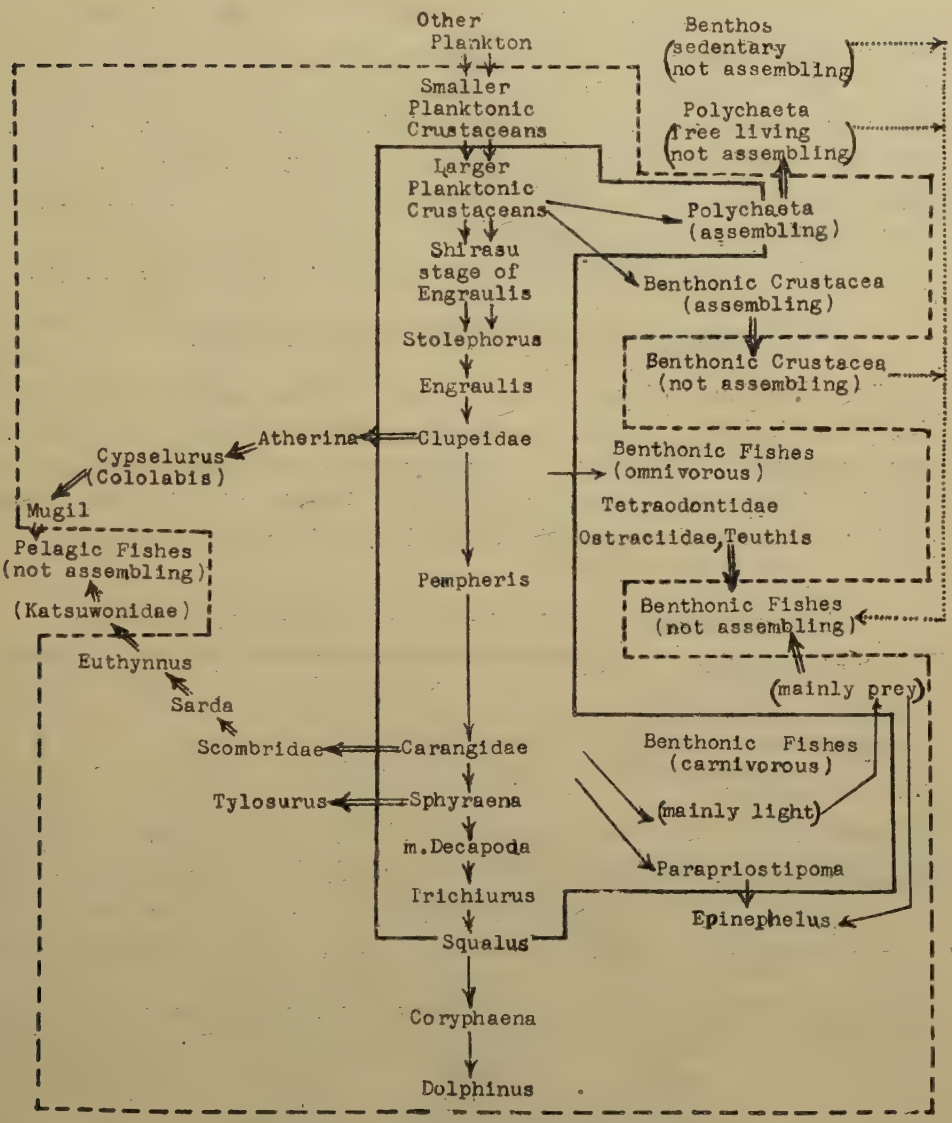



Fig. 2. Coaction in the lamp-community.

→ shows the direction of the ascension of food order.

⇒ shows the direction of the decrease of the light-assembling tendency in members of the same rank.

⇢ shows the direction of the increase of the capacity to assemble to the light, *i.e.* owing chiefly to the increase of the locomotive power.

Animals enclosed within the full line are the regular members of lamp-community having close interrelations with one another.

Animals enclosed between the broken line and the full one are those assembling under the lamp, but their behavior to light is rather unstable and interrelations between them not so strong as in the predating animals.

bitten by *Squalus* on the way being angled up. Usually *Epinephelus* and *Squalus* occupy vertically separated habitat, and there is no food relation between them, although *Epinephelus* resting among rocks is said to escape *Squalus* by the appearance in its neighborhood. From these facts as well as the degree of the dispersing activity and the tendency to approach the light, these animals seem to be arranged in the following order:—*Trichiurus*–*Epinephelus*—*Squalus*—*Coryphaena*—*Dorphinus*.

The whole relations mentioned above may be summarized as in Fig. 2.

### Quantity of Lamp Fishes in Each Food Rank

It is very hard to know the real amount of fishes assembling under the light. There is, indeed, no clear boundary, in which the animals may be said being assembled to the light; or practically it is impossible to estimate or catch the whole animals in the sphere, if such a boundary is admitted. In the following two tables, I tried to give some hints on item of this chapter.

Table 2. The biomass in each haul by present net indicated in weight (Kg.)

| haul number / food class | 1 | 2 | 3 | 4 | 5 | 6 | Total |
|---|---|---|---|---|---|---|---|
| Primary predators | 14 | 15 | 11 | 6 | 17 | 15 | 78 |
| Secondary predators | 4 | 7 | 4 | 3 | 0.5 | 1 | 19.5 |
| Tertiary predators | 5 | 1 | 1 | 1 | 0 | 0.5 | 8.5 |
| Quarternary predators | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 23 | 23 | 16 | 10 | 17.5 | 16.5 | 106.0 |

Table 3. Frequency of appearance of the animals in each food rank in 24 cases.

| Prey group | Primary predators | Secondary predators | Tertiary predators | Quarternary predators |
|---|---|---|---|---|
| 24 | 23 | 21 | 20(11)* | 4 |

* Here included many cases of the appearance of small molluscan Decapods which served as the primary predators rather than the tertiary ones. Thus only 11 cases were considered to be the real one.

The primary and the secondary predators are usually found as groups, but the tertiary and quarternary predators are occasional visitors to the light and the end predators are seldom observable. I could not find actually any animal of the end predators during the period of my observation.

The amount of the primary predators is the largest of all. Among them, *Engraulis* is most abundant, next comes *Stolephorus* and then followed by *Pempheris*. The amount of the secondary predators falls roughly between 1/10 and 1/4—1/2 of that of the primary predators, although the former may surpass the latter when *Euthynnus* or Scombrids gather in quantities. The amount of the tertiary predators is no more than a small part of the secondary predators, and the quarternary predators about a half of the tertiary predators. The members of the prey group occupy a small central space of the shoal under the lamp; moreover, they are very small in size. Consequently, the amount of this group is considered to be much smaller than that of the primary predators.

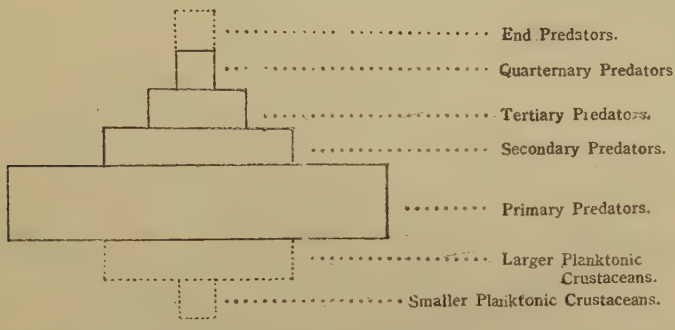



Fig. 3. Quantity of the lamp fishes in each food rank.

Fig. 3 represents the summarized idea of the above descriptions. From this figure, it may be said that the lower components in the present ecosystem, formed temporarily under the lamp, do not build the wide basal portion of the food pyramid as in the ordinary ecosystem.

So it may be supposed that the amounts of the prey group, the primary and the secondary predators are not only controlled by their preys but also the other factors induced by light.

## Social Structure of the Lamp-Community

We can actually observe merely the structure of the fish community in the superficial layer of the water. That of the deeper strata is only presumable from the results of angling or netting.

The structure of lamp community seems to be affected by both the color and intensity of light, current and predating action of the fish. Even one of these factors may affect the community so strongly that it may become very small and unstable, and consequently under certain cases when the two factors

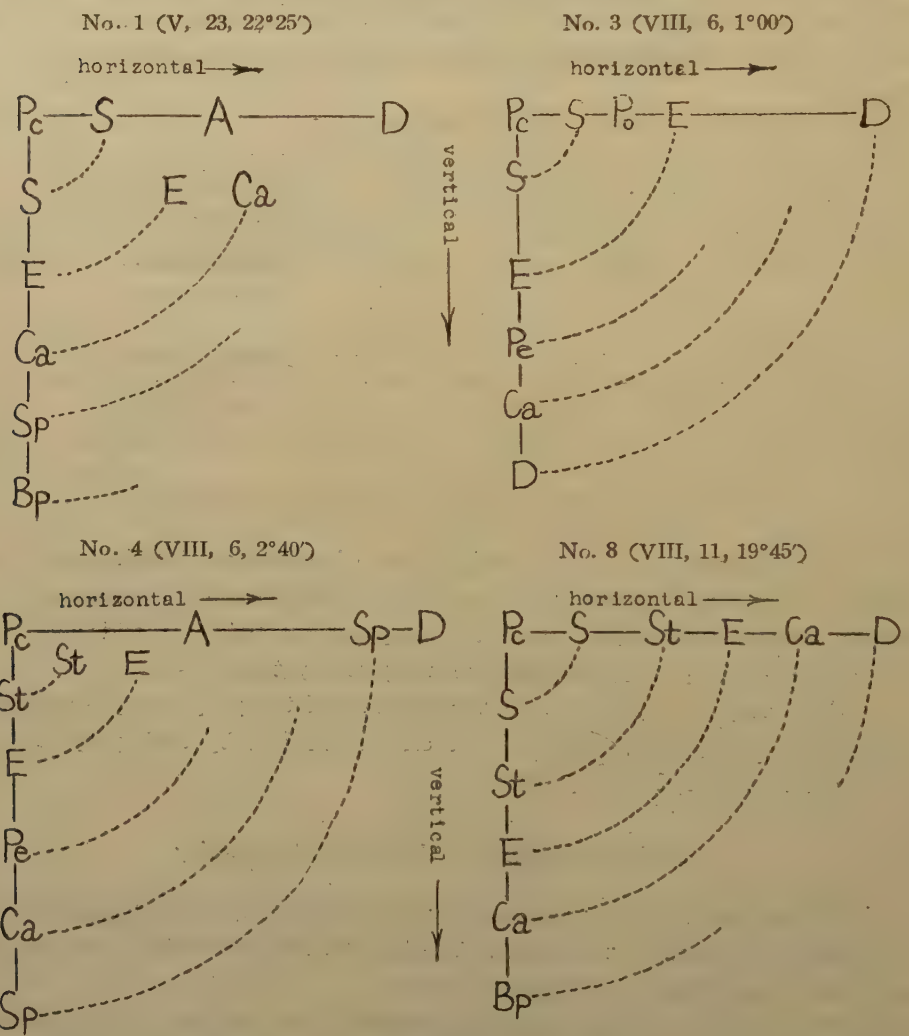
are effective together practically no animal group is formed under the lamp.

(1) Standard form.

The structure of the community under the condition when neither current nor predating action are effective may be called the standard form.

When the lamp is lighted, many fishes assemble irregularly one after the other and after a short time they attain an equilibrium condition in the

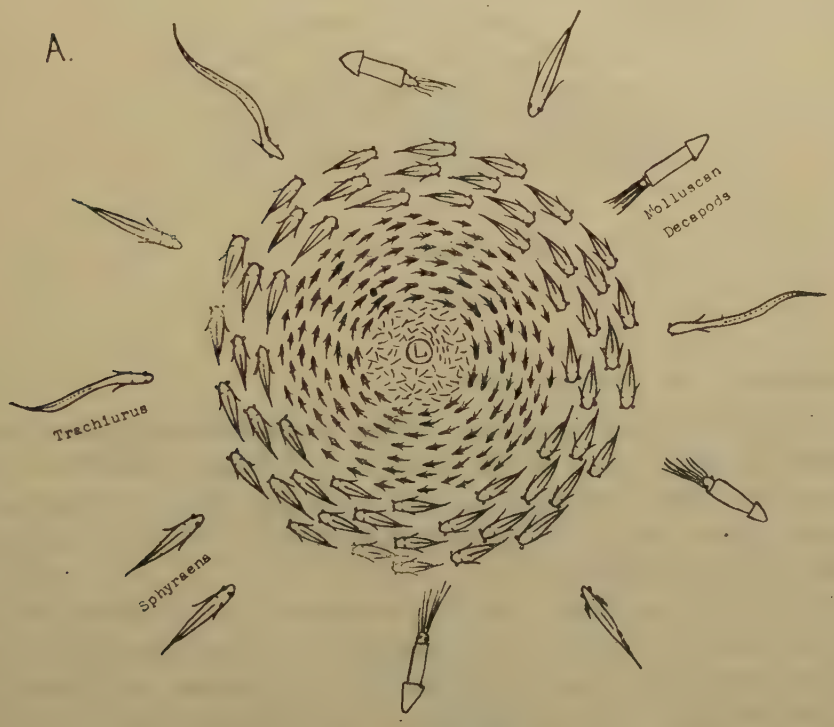
Fig. 4. Four actual cases of the standard form.




Pc: Planktonic Crustaceans, S: Shirasu stage of *Engraulis*, Po: Polychaetes,
St: *Stolephorus*, E: *Engraulis*, Pe: *Pempheris*, Ca: Carangidae,
Sp: *Sphyraena*, D: molluscan Decapods, Bp: Benthonic Fishes, A: *Atherina*.

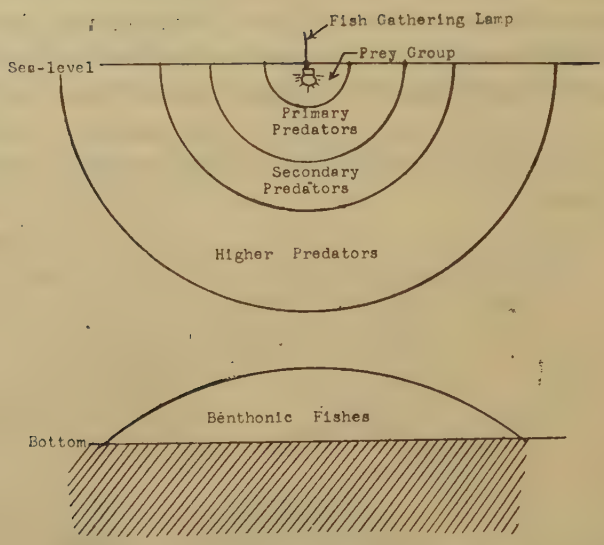
standard form. Fig. 4 is a schematic representation of the standard form in my observation. It is learned from these schemata that the nearest part to the lamp is occupied by the prey group, the next zone by the primary predators and then the more peripheral in the situation the higher in the food order. The vertical structure is supposed to be the same as the horizontal structure rotated at right angle. Here, the fishes of the "indifferent group" are seen only in the superficial layer, and the benthonic fishes only in the deeper layer. All other structures may be interpreted as modified forms of this standard form.

Fig. 5. Pictorial representation of the standard form.




(A Horizontal view)
L: Lamp.
—: Prey group.
: Primary predator.
: Secondary predator.
Other fishes show higher predators.

B




(B : Vertical view)

(2) Changes by the predating action.

When the predators increase in number or the predating action becomes remarkable in the periphery of the group in the standard form, the fishes of the lower food orders aggregate in more condensed mass in the center, but gradually abandon their central situations and the form of the group may be changed as is shown in Fig. 6.

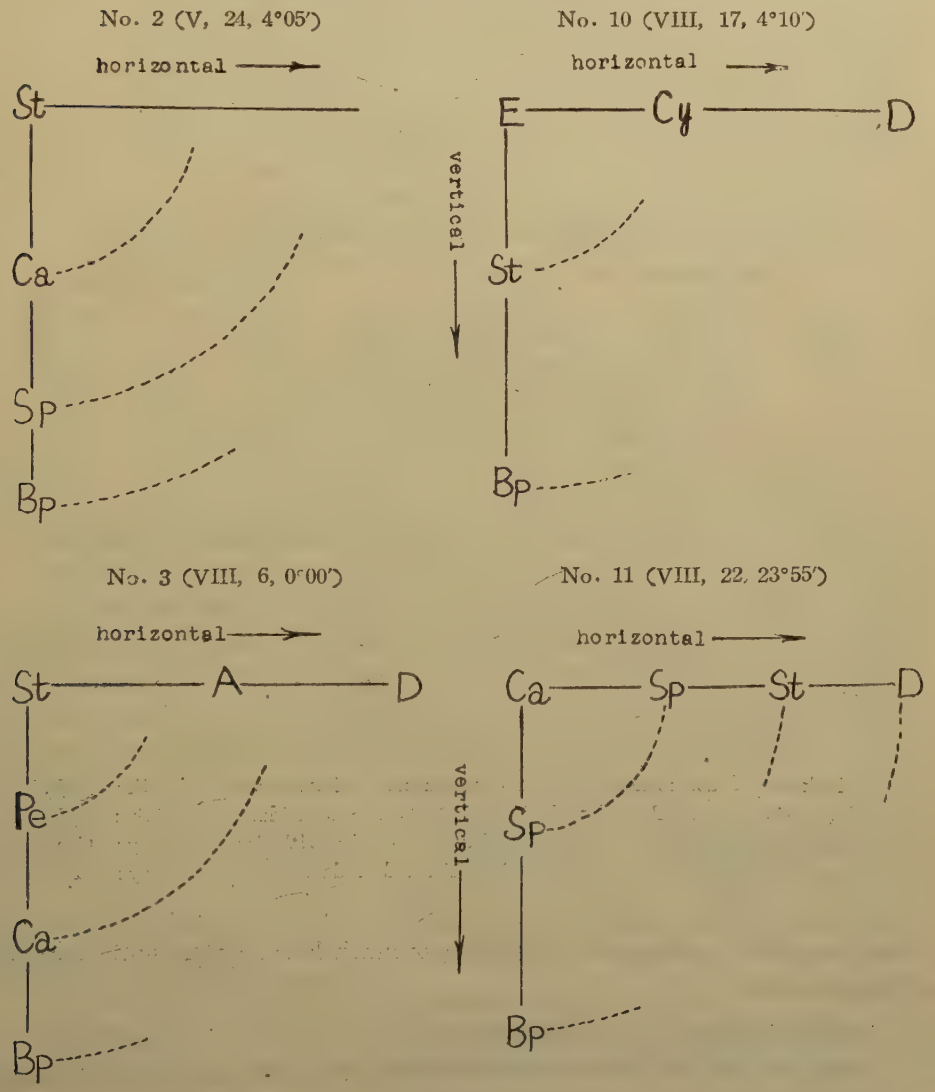
No. 2, No. 10 and No. 11) Aug. 23, 2h. 40 m.) or Fig. 6 represent the cases where the predating action is rather weak. Though the animals of the prey group are absent in the central part, they are not scattered, but are imigrating to the periphery. The arrangement of the other food order are quite the same as in the standard form; *i.e.*, the inner in the situation the lower in the food order. No. 1 may be a transitory phase from the standard form to the "reverse form" to be explained below.

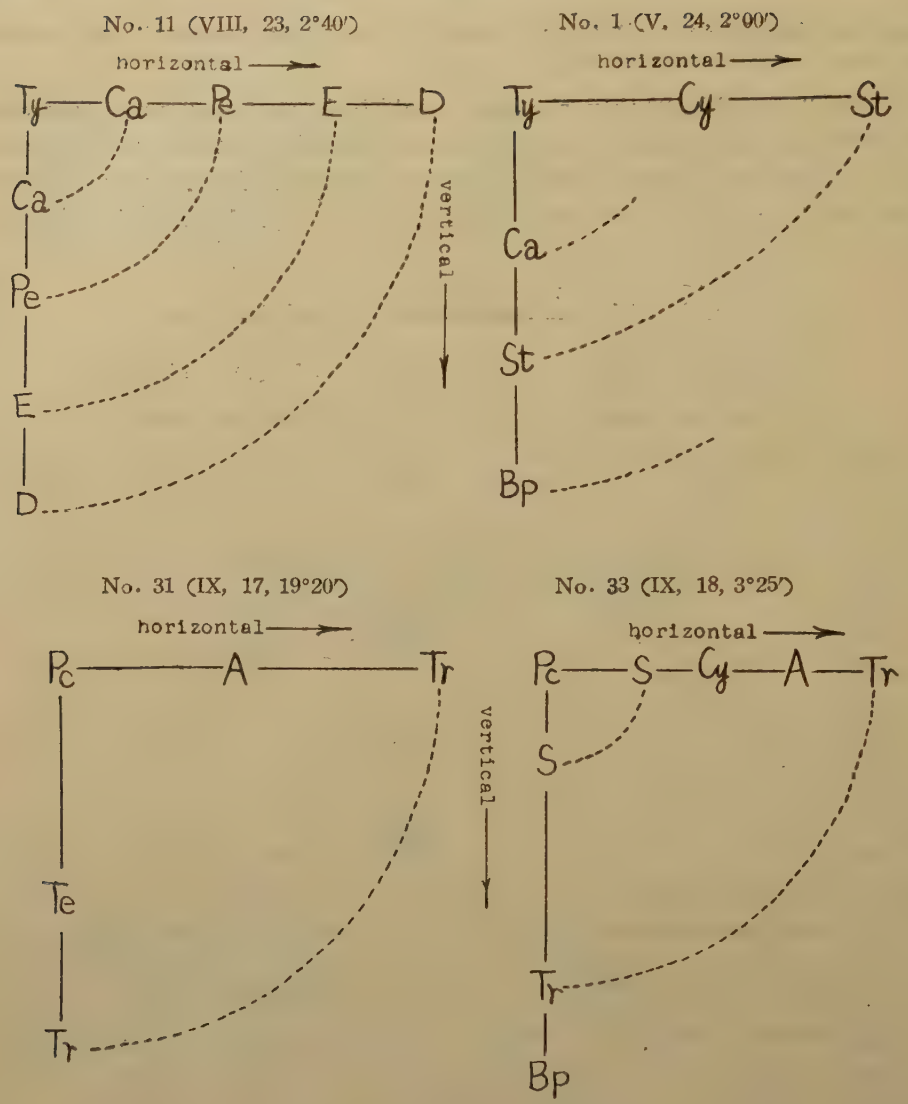
No. 3 and No. 11 (Aug. 22, 23h. 55m.) represent the cases in which the predating action is strong. The community structure becomes reversed completely from that of the standard form. The lower in the food order, the

more peripheral in the situation. This structure may be called the "reverse form."

No. 31 and No. 33 show the cases in which the predating action is violent. When the predating action is strong but in a certain limit the group becomes unstable, but not scattered. If the predation becomes much stronger, the group under the lamp becomes very poor and consists of predators only of higher

Fig. 6. Eight actual cases modified by predating action.





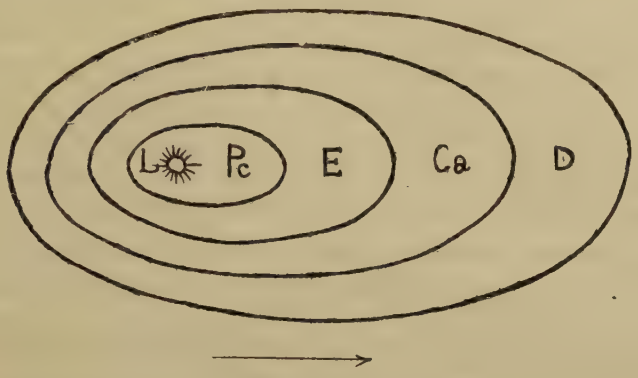

Pc: Planktonic Crustaceans, S: Shirasu stage of *Engraulis*, St: *Stolephorus*,
E: *Engraulis*, Pe: *Pempheris*, Ca: Carangidae, Sp: *Sphyraena*,
D: molluscan Decapods, Tr: *Trichiurus*, A: *Atherina*, Cy: *Cypselurus*,
Bp: Benthonic Fishes, Te: Tetraodontidae, Ty: *Tylosurus*.

orders sometimes accompanied by fishes of much lower orders quite unrelated with predators.

(3) The modification caused by the current.

While the weak current has little influences, the strong current alters

much the amount as well as the number of component species of the lamp community. The locomotive power of lamp animals is closely related with their size, which is a decisive factor to determine their food taking capacity. The animals of lower food orders are usually small in size and has poor locomotive power, and consequently they are unable to approach the lamp in strong currents. When the current flows very rapidly, any animals can not be seen under the lamp.




No. 8 (VIII, 12, 4°00′)

Fig. 7. Case No. 8, an example of modification by current.

L : Fish gathering lamp.
Pc: Planktonic crustaceans, E: *Engraulis*,
Ca: Carangidae. D: Molluscan decapods.

(4) Successional changes of the community structure under the same lamp.

i. The sequence of animals assembling to the lamp.

The sequence of chief animals assembling to the lamp may be roughly conceivable from Table 4. *Sphyraena* is considered to be a very late arrival to light, because it was the third arrival in two cases and sixth in a case. Molluscan Decapods, which were the second or third arrivals, were all very small and were treated to belong to prey group. The assembling order of larger Decapods as the tertiary predator is much later. In a case when a sword-fish *Trichiurus* was the second arrival, no fish assembled after it. From these facts the order to assemble to the light in the above mentioned fishes may be as follows: Carangidae—*Sphyraena*—molluscan Decapods—*Trichiurus*. It is noteworthy that the order is quite parallel to the food order, except in the case of *Stolephorus*.

ii. Successional changes in the structure from the lighting to the dawn.

The changes are divided into two processes, the formation and the dispersion of the group, although the latter process can not be observed perfectly,

Table 4. Order of arrival to the lamp.

| Name of animal / Order of arrival | Planktonic Crustaceans | "Shirasu" | *Stolephorus* | *Engraulis* | *Pempheris* | Carangidae | *Sphyraena* | m. Decapods | *Trichiurus* | *Atherina* | *Cypselurus* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| First | 28 | 6 | 2 | 3 | | | | | | 5 | 2 |
| Second | 2 | 7 | 1 | 8 | 1 | 2 | | 3 | 1 | 7 | 4 |
| Third | 1 | 1 | 3 | 6 | 3 | 2 | 2 | 2 | | 5 | 3 |
| Forth | | 2 | 3 | 3 | 1 | 3 | | 1 | 3 | 2 | 2 |
| Fifth | | | 1 | | | 1 | | 3 | | 2 | 1 |
| Sixth | | | | | | 2 | 1 | 1 | | 1 | 1 |
| Seventh | | | 1 | | | | | 1 | | | |
| Eighth | | | | | | | | 1 | | | |

because it takes place in a very short time and moreover it becomes very hard to see through the water under the dawning sky.

After the lighting, such animals of the prey group as planktonic crustaceans, Polychaeta and Shirasu come first. They begin to appear under the lamp within a minute time, and increase gradually till they are surrounded by predator fishes, which disperse the former. Planktonic crustaceans are scattered around the lamp showing irregular whirling movements. The fishes of Shirasu stage appear at first in very small groups, each of which consists of only a few individuals, but these groups unite gradually one after the other to form one or two circulating shoals circulating around the lamp. *Atherina* and *Cypselurus* begin to visit the lamp before the above mentioned prey animals gather in abundance and keep themselves near the lamp, approaching or apart from the light. While *Atherina* has the tendency to increase in number and forms a group, such phenomenon could not be observed in *Cypselurus*.

By this time or a little before the time when the prey animals form stable shoals, the benthonic fishes begin to be angled and *Engraulis* of the deeper layer begin to float up and come to our sight. *Engraulis* swims, at the beginning, solitarily in random directions, but as it increases in number it forms several groups; the sphere in which these groups swim around becomes wider and wider with time, and at last, the groups are united into single group circulating around the lamp. At this stage, the animals of the prey group show the decreasing tendency and Clupeids, *Pempheris*, Carangids and a few mollus-

can Decapods begin to appear under the light. The directions of circulation of *Engraulis* groups are variable at first, but acquire the stableness with the time. The group grows gradually larger and denser but the diameter of the circulation becomes smaller and smaller.

*Pempheris* and Carangid fishes show similar behavior as *Engraulis*, increasing in number and forming a group in the same way, and begin to circulate outside the zone occupied by *Engraulis*. Fishermen set the net and induce the fish group into it by moving the light into the enclosure at the proper time when the circulatory movement of these fishes is settled in the stable condition. By the appearance of the predators, the shoal of *Engraulis*, however, becomes unstable again at that time.

Decapods appear in the periphery of the group a little after the formation of the stable group of Carangids and eat them. Lastly *Trichiurus*, *Squalus*, *Coryphaena* and *Dolphinus* approach the light and the shoals of Carangid fishes are destructed suddenly. Considering these processes, the time of setting the net must be decided most carefully. The destructing power of the predators of higher food orders on the lamp community is very strong, but wonderfully that of the net is rather weak. The fishes escaped from the net may assemble again to a nearby lamp. During these processes, benthonic fishes are angled at irregular intervals. *Sarda*, Scombrids and some benthonic fishes like *Parapristipoma*, which had been assembled in rather deeper layer, may float up to the upper layer, if the light is kept long enough.

About an hour before the dawn, the predating action of the benthonic fishes becomes suddenly stronger. *Stolephorus* which remained till that time in the deeper layer under the light, floats up near the light and takes the place of *Engraulis*, which is pushed aside to the periphery and there eaten by Squids *Sphyraena* and *Trichiurus*. *Stolephorus* is then attacked by *Sphyraena* and driven from the central part to the periphery. By this process, the reversal of the situation of *Stolephorus* and *Sphyraena* was observed at several times. In spite of the predating attack of *Sphyraena*, *Stolephorus* maintains the situation near the lamp and swims around it till the dawn, when the behavior of this fish become obscure. At the dawn Carangid fishes are the first to disappear from the group, then other fishes roughly in the order of food chain both in higher and lower directions. The benthonic fishes become gradually irresponsive to the bait after the dawn.

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# 日本貝類圖錄

# Illustrated Catalogue of Japanese Shells

Edited by Dr. Tokubei Kuroda

April 25, 1951 Donacidae and Myidae No. 12.

## 日本産フヂノハナガヒ科, 及び エゾオホノガヒ科

波 部 忠 重

## Donacidae and Myidae in Japan

by

Tadashige HABE

### Family Donacidae (フヂノハナガヒ科)

### Genus *Donax* Linné 1758 (フヂノハナガヒ屬)

1758 *Donax* Linné, Syst. Nat., ed. 10, p. 682.

Type species: *Donax rugosa* Linné (designated by Gray 1847)

### Subgenus *Chion* Scopoli 1777 フヂノハナガヒ屬

1777 *Chion* Scopoli, Introd. Hist. Nat., p. 398.

Type species: *Donax denticulatus* Linné (designated by Gray 1847)

#### 1. *Donax* (*Chion*) *semigranosus* Dunker フヂノハナガヒ

Pl. 12, figs. 10, 11.

1871 *Donax dysoni* Lischke, Jap. Meer. Conchyl., **2**, p. 112., non Deshayes 1855.
1877 *Donax semigranosus* Dunker, Malak. Bl., **24**, p. 68.
1881 *Donax proximus* Bertin, Nouv. Arch. Mus., p. 100, pl. 3. figs. 2a–c.
1882 *Donax semigranosus* Dunker, Index Moll. Mar. Japon, p. 193, pl. 7, figs. 14–16.
1922 *Donax introradiatus* Yokoyama, Jour. Coll. Sci. Imp. Univ. Tokyo, **44** (1), p. 136, pl. 9, figs. 8, 9 non Reeve 1855.

Length 13.0 mm., height 9.0 mm. breadth 5.2 mm. (figured specimen collected from Tsu City on the coast of Ise Bay, Honshu).

Type locality: Japan.

Distribution: Formosa; Kyushu; Shikoku and Honshu.

#### 2. *Donax* (*Chion*) *kiusiuensis* Pilsbry キウシウナミノコガヒ

Pl. 12, figs. 3, 4.

1901 *Donax kiusiuensis* Pilsbry, Proc. Acad. Nat. Sci. Phila, **53**, pp. 207, 400, pl. 20, fig. 19.



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Contribution No. 162

1927 *Donax paululus* Yokoyama, Jour. Fac. Sci. Imp. Univ. Tokyo, (2) **1** (10), p. 455, pl. 52, fig. 6.

Length 11.8 mm., height 6.7 mm., depth 2.0 mm., (figured specimen; right valve collected from Hakodate, Hokkaido).

Type locality: Hirado, Nagasaki Pref., Kyushu.

Distribution: Formosa; Okinawa; Kyushu; Honshu and Hokkaido.

Subgenus *Latona* Schumacher 1817 ナミノコガヒ属

1817 *Latona* Schumacher, Essai Nouv. Syst. Vers. Test., pp. 52, 156.

Type species: *Donax cuneata* Linné (designated by Gray 1847).

3. *Donax* (*Latona*) *cuneatus* Linné ナミノコガヒ

Pl. 12, figs. 7, 8.

1758 *Donax cuneata* Linné, Syst. Nat. ed. 10, p. 683.

1791 *Donax bicolor* Gmelin, Syst. Nat., ed. 13, p. 3265.

1818 *Donax australis* Lamarck, Anim. s. Vert., **5**, p. 548.

Length 18.3mm., height 11.4mm., breadth 5.8mm. (figured specimen collected from Noto Peninsula, Honshu).

Type localily: ——.

Distribution: Indo-Pacific Region; Formosa to Honshu.

4. *Donax* (*Latona*) *faba* Gmelin リウキウナミノコガヒ

Pl. 12, fig. 6.

1791 *Donax faba* Gmelin, Syst. Nat., ed. 13, p. 3264.

1818 *Donax radians* Lamarck, Anim. s. Vert. **5**, p., 547.

Length 19.5mm., height 14.0mm., breadth 7.2mm. (figured specimen collected from Okinawa).

Type locality: ——.

Distribution: South-West Pacific region: Formosa; Okinawa and Amami groups.

5. *Donax* (*Latona*) *ticaonicus* Hanley クサビナミノコガヒ

Pl. 12, figs. 5.

1845 *Donax ticaonicus* Hanley, Proc. Zool. Soc. London, **13** (144), p. 14.

1854 *Donax ticaonica* Reeve, Conch. Icon., sp. 13.

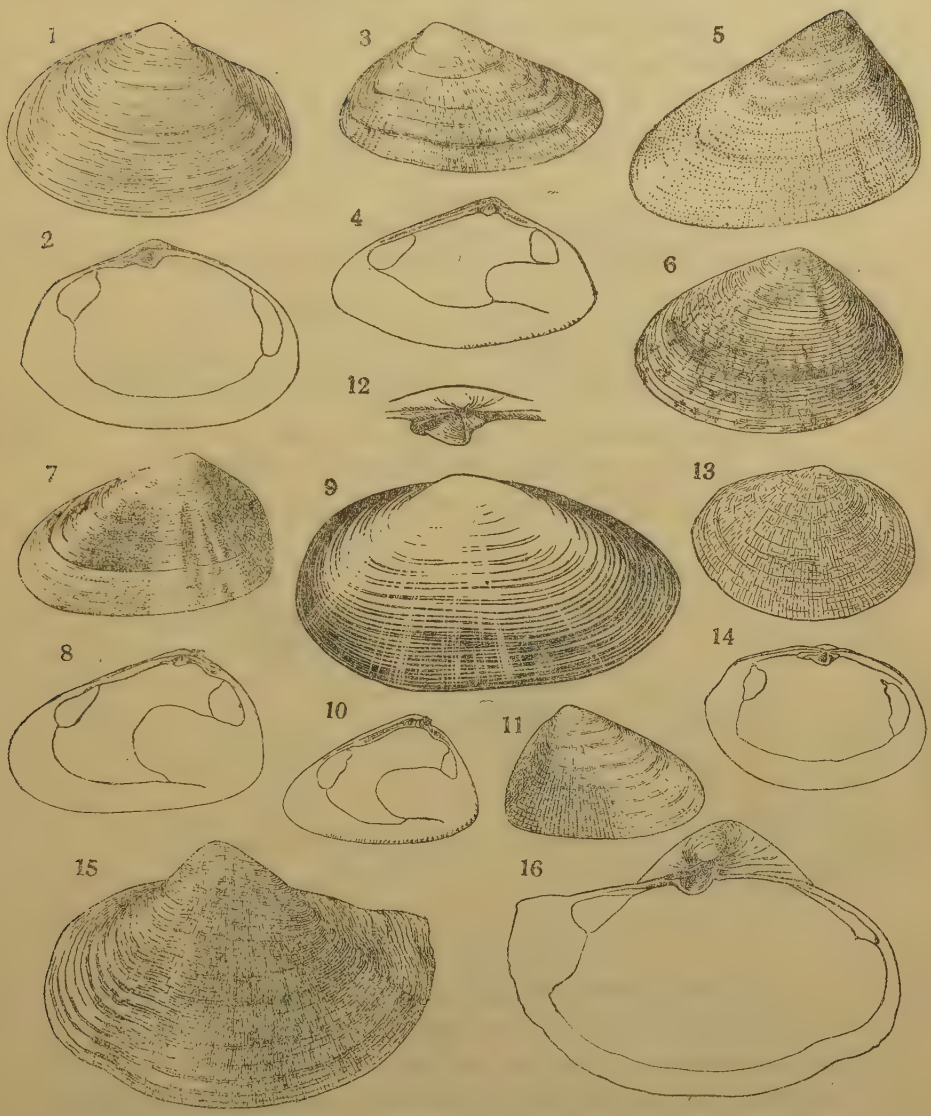
1941 *Donax* (*Latona*) *ticaonicus* Kuroda, Mem. Fac. Sci. Agr. Taihoku Imp. Univ., **22** (4), p. 167, pl. 5, fig. 81.

Length 21.6 mm., height 15.8 mm., depth 4.4 mm. (figured specimen collected from Takao, Formosa collected by T. Kuroda).

Type locality: Ticao, Philippines.

Distribution: Philippines and Formosa.

## Plate 12. Donacidae and Myidae




### Explanation of Plate 12. 第12圖版說明

Figs. 1, 2. *Cryptomya busoensis* Yokoyama ヒメマスホガヒ, 12.7×8.6 mm. p. 75.
3, 4. *Donax* (*Chion*) *kiusiuensis* Pilsbry キウシウナミノコガヒ, 11.8×6.7 mm. p. 71.
5. *Donax* (*Latona*) *ticaonica* Hanley クサビナミノコガヒ, 21.6×15.8mm. p. 72.
6. *Donax* (*Latona*) *faba* Gmelin リウキウナミノコガヒ, 19.5×14mm. p. 72.
7, 8. *Donax* (*Latona*) *cuneatus* Linné ナミノコガヒ, 18.3×11.4mm. p. 72.
9. *Mya* (*Arenomya*) (*arenaria* var.) *japonica* Jay オホノガヒ, 86.7×52.0mm. p. 74.
10, 11. *Donax* (*Chion*) *semigranosus* Dunker フヂノハナガヒ, 13×9mm. p. 71.
12, 13, 14. *Venatomya truncata* (Gould) クシケマスホガヒ, 12.8×8.9mm. p. 75.
15, 16. *Distugonia decurvata* (A. Adams) オフクマスホガヒ, 29.6×21mm. p. 75.

Family Myidae エゾオホノガヒ科

Genus *Mya* Linné 1758 エゾオホノガヒ屬

1758 *Mya* Linné, Syst. Nat., ed. 10, p. 670.

Type species: *Mya truncata* Linné (designated by Children 1823)

1. *Mya truncata* Linné エゾオホノガヒ

Textfigs. 1, 2.

1758 *Mya truncata* Linné, Syst. Nat., ed. 10, p. 670.

Length 96.9 mm., height 71.8 mm., breadth 48.9 mm. (figured specimen collected from Nemuro, Hokkaido collected by T. Sasamori).

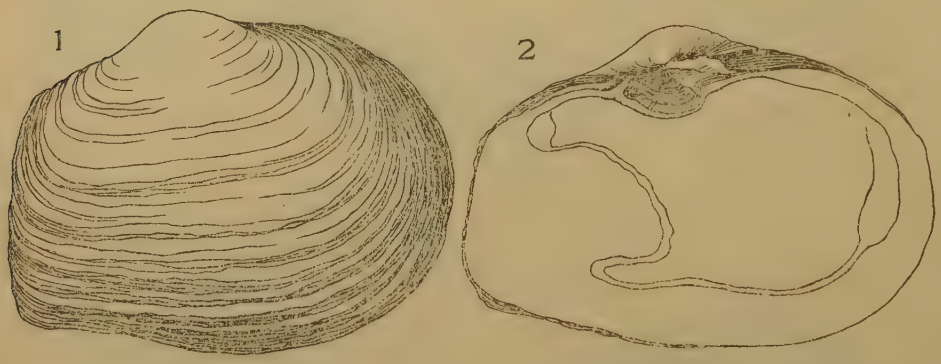
Type locality: Liverpool, England.

Distribution: Circumpolar in Arctic waters; Hokkaido and Saghalien.

Subgenus *Arenomya* Winckworth 1930 オホノガヒ亞屬

1930 *Arenomya* Winckworth, Proc. Malac. Soc. London, **19**, p. 15.

Type species: *Mya arenaria* Linné (original designation)




Text-figs. 1, 2. *Mya truncata* Linné エゾオホノガヒ

2. *Mya* (*Arenomya*) (*arenaria* var.) *japonica* Jay. オホノガヒ

Pl. 12, figs. 9.

(1758 *Mya arenaria* Linné, Syst. Nat., ed. 10, p. 670).

1857 *Mya japonica* Jay, Rep. Japan Exped. Comm. Perry, **2**, p. 292, pl. 1, figs. 7, 10.

Length 86.7 mm., height 52.0 mm., breadth 31.0 mm. (figured specimen collected from Prov. Iyo (=Ehime Pref.), Shikoku.

Type locality: Volcano Bay, Island of Yeddo (=Funka-Wan, Hokkaido).

Distribution: Kyushu; Shikoku, Honshu, Hokkaido and Saghalien.

Genus *Cryptomya* Conrad 1848 ヒメマスホガヒ屬

1848 *Cryptomya* Conrad, Proc. Acad. Nat. Sci. Phila., **4**, p. 121.

Type species: *Sphaenia californica* Conrad (monotypy)

3. *Cryptomya busoensis* Yokoyama ヒメマスホガヒ

Pl. 12, figs. 1, 2.

1922 *Cryptomya busoensis* Yokoyama, Jour. Coll. Sci. Imp. Univ. Tokyo, **44** (1), p. 126, pl. 7, figs. 1, 2.

Length 12.7 mm., height 8.6 mm., depth 2.9 mm. (figured specimen collected from the Akkeshi Bay, Hokkaido).

Type locality (fossil): Otake, Chiba Pref., Honshu.

Distribution: Honshu; Hokkaido; Kwanto District, Honshu (Pleistocene).

Genus *Distugonia* Iredale 1936 オフクマスホガヒ屬

1936 *Distugonia* Iredale, Rec. Austr. Mus., **19** (5), p. 283.

Type species: *Distugonia inopinata* Iredale (original designation).

4. *Distugonia decurvata* (A. Adams) オフクマスホ

Pl. 12, fig. 15, 16.

1851 *Sphaenia decurvata* A. Adams, Proc. Zool. Soc. London, p. 88 (1850).

Length 29.6 mm., height 21.0 mm., depth 9.5 mm. (figured specimen collected from the Kagoshima Bay, Kyushu by A. Teramachi).

Type locality: Catanuan, Province of Tayabas, Island of Luzon, in sand at low water.

Distribution: Philippines; Kyushu; Shikoku and Honshu.

Genus *Venatomya* Iredale 1930 クシケマスホガヒ屬

1930 *Venatamya* Iredale, Rec. Austr. Mus., **17** (9), p. 403.

Type species: *Sphaenia elliptica* A. Adams (original designation)

5. *Venatomya truncata* (Gould) クシケマスホ

Pl. 12, figs. 12, 13, 14.

1861 *Cryptomya truncata* Gould, Proc. Boston Soc. Nat. Hist., **8**, p. 24.

1882 *Cryptomya elliptica* Dunker, Index Moll. Mar. Jap., p. 178, pl. 7, figs. 17–19, non *Sphaenia elliptica* A. Adams 1851).

1927 *Cryptomya tachibanensis* Yokoyama Jour. Fac. Sci. Imp. Univ. Tokyo, (2) **1** (10), p. 454, pl. 52, fig. 5.

Length 12.8 mm., height 8.9 mm., breadth 5.1 mm. (figured specimen collected from Yosa-naikai, Kyoto Pref., Honshu).

Type locality: China Sea, lat. 24°.

Distribution: China; Kyushu; Shikoku and Honshu.

*Sphenia* Turton 1882 イヂケガヒ屬

1822 *Sphenia* Turton, Conch. Ins. Brit., p. 36.

Type species: ***Sphenia binghami*** Turton (designated by Gray 1847).

6. ***Sphenia coreanica*** new species イヂケガヒ

Text-figs. 3, 4.

Sheil rather small, ashy white, irregular in shape, generally round or ovate; posterior margin bluntly truncated; the right valve embrances the left one whihc is smaller, somewhat flatter than the other as in many *Aloidis*; beaks slightly prominent; an obtuse keel running from the beak to the postero-ventral corner; surface marked with distinct wrinkles of growth lines, without any radial threads; periostracum rather deciduous, remained only on the posterior area; ligament internal; chondrophore small in the left valve and receptacle pit in the right valve. Interior of valves white and polished; anterior and osterior muscle scars are connected with the discontinuous mantle line with a distinct sinus.

Text-figs. 3, 4. *Sphenia coreanica* n. sp. イヂケガヒ (figured from type specimen).

Length 7.5 mm., height 5.9 mm., breadth 3.8 mm. (conjoined type specimen)
Length 6.0 mm., height 6.3 mm., breadth 4.0 mm. (paratype).
Length 7.3 mm., height 6.1 mm., breadth 4.1 mm. (paratype).

Type locality: Ulsan, Southern Corea (Japan Sea coast) (collected by Waichi Hatakeda).

Remarks: This small *Hiatella*-like species is the first species belonging to this genus from the seas around Japan. So far as I can ascertain there is no species to be compared with this new species.

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List of the marine molluscan genera, subgenera and sections (Tertiary to Recent) established by the Japanese authors (1925—1949). (No. 3)

*37. *Mormuretla* Nomura 1939, (as a section of *Turbonilla* Risso 1826), Jubilee Publ.

Comm. H. Yabe's 60th Birthday, p. 125. (Orthotype: *Turbonilla* (*Mormula*) *chitaniana* Yokoyama) (Pyramidellidae).

38. *Neodoris* Baba 1938, Jour. Depart. Agr. Kyusyu Imp. Univ., vol. 6, no. 1, p. 13 (Orthotype: *Neodoris tricolor* Baba) (Doridiidae).

*39. *Nipponomarcia* Ikebe 1941, (as a subgenus of *Katelysia* Roemer 1857), Venus, vol. 11, nos. 2-3, p. 50. (Orthotype: *Nipponomarcia nakamurai* Ikebe) (Veneridae).

40. *Niveotectura* Habe 1944 (seems to be a synonym of *Acmaea* Eschscholtz 1823) Jap. vol. 13, nos. 5-8, pp. 173, 185 (Haplotype *Tectura* (*Niveotectura*) *pallida* (Gould)) Jour. Malac. (Acmaeidae).

*41. *Numaegilina* Nomura 1938 (as a subgenus of *Chrysallida* Carpenter 1857) Saito Ho-on Kai Mus. Res. Bull., no. 16, p. 65 (Orthotype; *Chrysallida* (*Numaegilina*) *gloria* Nomura) (Pyramidellidae).

42. *Okadaia* Baba 1930, Venus, vol. 2, no. 2, pp. 47-48. (Orthotype: *Okadaia elegans* Baba (Vayssiereidae).

43. *Omphalotukaia* Yoshida 1948 (as a section of *Calliostoma* Swainson 1840), Venus (Jap. Jour. Malac.), vol. 15, nos. 1-4, p. 36 (Orthotype: *Calliostoma* (*Otukaia*) *hajimeanum* Yoshida) (Trochidae).

44. *Otukaia* Ikebe 1941 (as a subgenus of *Calliostoma* Swainson 1840), Venus, vol. 11, nos. 2-3, p. 60 (Orthotype: *Calliostoma kiheiziebisu* Otuka) (Trochidae).

45. *Paracingulina* Nomura 1936 Saito Ho-on Kai Mus. Res. Bull., no. 10, p. 47 (Orthotype *Cingulina triarata* Pilsbry) (Pyramidellidae). (a synonym of *Pseudocingulina* Nomura 1936),

*46. *Paradrillia* Makiyama 1940, Jour. Geol. Soc. Japan, vol. 47, pp. 133-134 (Orthotype: *Drillia dainichiensis* Yokoyama) (Turridae)

*47. *Paragrammatodon* Nomura and Niino 1940 Rec. Oceanogr. Works Japan, vol. 12, no. 1, p. 42 (Orthotype: *Pseudogrammatodon pacificus* Nomura et Zinbo) (Arcidae). (a synonym of *Samacar* Iredale 1936),

48. *Paramormula* Nomura 1939 (as a section of *Turbonilla* Risso 1826), Jubilee Publ. Comm. H. Yabe's 60th Birthday, p. 124 (Orthotype: *Turbonilla varicosa* Dunker) (Pyramidellidae).

49. *Paratritonia* Baba 1949, Opisthobranchia of Sagami Bay, pp. 84, 166, (Orthotype: *Paratritonia lutea* Baba) (Duvauceliidae).

50. *Peregrinamor* Shoji 1938, Venus, vol. 8, nos. 3-4, pp. 124-128 (Orthotype: *Peregrinamor ohshimai* Shoji) (Gaimardiidae).

51. *Petroderma* Kuroda 1950, Jap. Jour. Malac., vol. 14, nos. 1-4, pp. 29-32 (Haplotype: *Petroderma thaanumi* Kuroda) (Carditidae).

52. *Pictocolumbella* Habe 1945 Jap. Jour. Malac., vol. 14, nos. 1-4, p. 4 (Haplotype: *Columbella* (*Pictocolumbella*) *fulgurans* Lamarck) (Columbellidae). (a synonym of *Pusiostoma* Swainson 1840),

53. *Pictodiloma* Habe 1946 (as a subgenus of *Diloma* Philippi 1845), Jap. Jour. Malac., vol. 14, nos. 5-8, pp. 196 (Haplotype: *Diloma* (*Pictodiloma*) *suavis* (Philippi)) (Trochidae).

54. *Protocallithaca* Nomura 1937 (a synonym of *Callithaca* Dall 1902), Saito Ho-on Kai Mus. Res. Bull., no. 13, p. 11 (Orthotype: *Venus adamsi* Reeve) (Veneridae).

*55. *Protorotella* Makiyama 1925, Jap. Jour. Geol. Geogr., vol. 3, p. 127 (Orthotype: *Protorotella yuantaniensis* Makiyama) (Trochidae).

56. *Protoxylophaga* Iw. Taki et Habe 1945, Jap. Jour. Malac., vol. 14, nos. 1–4, p. 112 (Orthotype: *Protoxylophaga tomlini* (Prashad)) (Xylophaginidae).

*57. *Pseudoamiantis* Kuroda 1933, Gastropoda and Lamellibranchia, Iwanami-Koza (Geology and Palaeontology), p. 63 (Orthotype: *Meretrix tauyensis* Yokoyama) (Veneridae).

58. *Pseudobornella* Baba 1932, Annot. Zool. Japon., vol. 13, no. 4, pp. 369–376 (Orthotype: *Pseudobornella orientalis* Baba) (Bornellidae).

59. *Pseudocingulina* Nomura 1935 (as a section of *Cingulina* A. Adams 1860), Saito Ho-on Kai Mus. Res. Bull., no. 10, p. 11 (Orthotype: *Cingulina triarata* Pilsbry) (Pyramidellidae).

*60. *Pseudopalliorum* Oyama 1944 (as a subgenus of *Propeamussium* De Gregorio 1884), Jap. Jour. Malac., vol. 13, nos. 5–8, p. 244 (Orthotype: *Pecten interradiatus* Gabb) (Pectinidae).

61. *Pseudosacculus* S. Hirase 1928 (a new name for *Sacculus* S. Hirase 1927 non Gosse 1851), Annot. Zool. Japon., vol. 11, p. 417 (Haplotype: *Sacculus okai* S. Hirase) (Pseudosacculidae).

62. *Puncticingulina* Nomura 1938 (as a section of *Cingulina* A. Adams 1860), Saito Ho-on Kai Mus. Res. Bull., no. 16, p. 40 (Tautotype: *Cingulina* (*Puncticingulina*) *puncticingulina* Nomura) (Pyramidellidae).

63. *Rissosyrnola* Nomura 1939 (as a subgenus of *Costosyrnola* Laws 1937), Jubilee Publ. H. Yabe's 60th Birthday, p. 123 (Orthotype: *Mormula aclis* A. Adams) (Pyramidellidae).

64. *Sacculus* S. Hirase 1927 (see *Pseudosacculus*) Annot. Zool. Japon., vol. 11, no. 2, pp. 115–126 (Haplotype: *Sacculus okai* S. Hirase) (Pseudosacculidae),

65. *Saotomea* Habe 1943 (as a subgenus of *Fulgoraria* Schumacher 1817), Jap. Jour. Malac., vol. 13, nos. 1–4, p. 73 (Haplotype: *Fulgoraria* (*Saotomea*) *delicata* (Fulton)) (Volutidae).

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# *Asterospicularia laurae*, n. gen. et n. sp., the Type of a New Family of Alcyonarians with Stellate Spicules

HUZIO UTINOMI[1]

AMONG THOSE SPECIMENS of Alcyonaria obtained during my trip to Formosa in 1938, there is an interesting form which cannot be referred to any known genus of the group. It is represented only by a single specimen obtained on the coral reef at Daijubô, southernmost promontory of Formosa, on June 14, 1938. Superficially it shows a resemblance to the genus *Capnella* in the mode of branching and in the appearance of polyps. Closer examination of the total specimen and sectioned preparations, however, has revealed that the coenenchyma as well as the polyp wall has a honeycombed texture filled with numerous stellate spicules and that the tentacles bear no trace of pinnules. Such characters are entirely unknown in the whole group of Alcyonaria, so I propose to institute for this form a new genus and even a new family.

The following description is based on a perfect specimen which was taken as the type.

## EXTERNAL APPEARANCE

The specimen (Fig. 1*a*) is in the form of a small colony of bushy growth and has a yellowish white colour in alcohol. The base of the colony is broadened, flattened, and about 12 mm. in longest diameter. From the flattened upper surface of the short columnar stem arise nine large and small polyp-bearing lappets. Each of the lappets is mushroom-shaped; each consists of a polyp-bearing rounded capitulum and a short wide sterile stalk, the former being marked off sharply from the latter. In the largest lappet, the capitulum is about 6 mm. in diameter and 5 mm. in height, and the stalk is about 8 mm. in diameter and 5 mm. in height. The total height of the colony is about 13–17 mm.

No polyp dimorphism is found. The autozooids are closely set and rather large, being up to 1 mm. in diameter and 1.5 mm. in height. They are apparently capable of considerable contraction, and they look like papillae provided with a rather large central mouth surrounded by eight-lobed tentacles (Fig. 1*b*). The whole surface of the trunk of the zooid is thickly covered with stellate spicules of sub-equal size which are continued onto the dorsal surface of the tentacles. The spicules are evenly scattered as in the Xeniidae and do not form any densely packed row or ridge along the intermesenteric area (Fig. 1*c*).

The tentacles, in the contracted state, appear oval in side view and measure about 0.5 mm. long and 0.37 mm. wide (Fig. 1*d*). The pinnules are missing. Careful microscopic examination of serial sections of the tentacle reveals that from 8 to 10 opaque rounded bodies are imbedded slightly beneath the oral surface of the tentacles (Fig. 2*c*). These bodies are scattered here and there in the peripheral layer, but are closely united with one another in the deeper layer; they are continuous with the coelenteric cavity below the mouth. The interior is filled with numerous zooxanthellae and endoderm cells, and there is no connection between this region and the epidermis. Here the epidermis shows no sinus or indentation suggesting the presence of pinnules. Thus I consider this body

[1]Seto Marine Biological Laboratory, Sirahama, Wakayama-Ken, Japan. Manuscript received September 6, 1950.

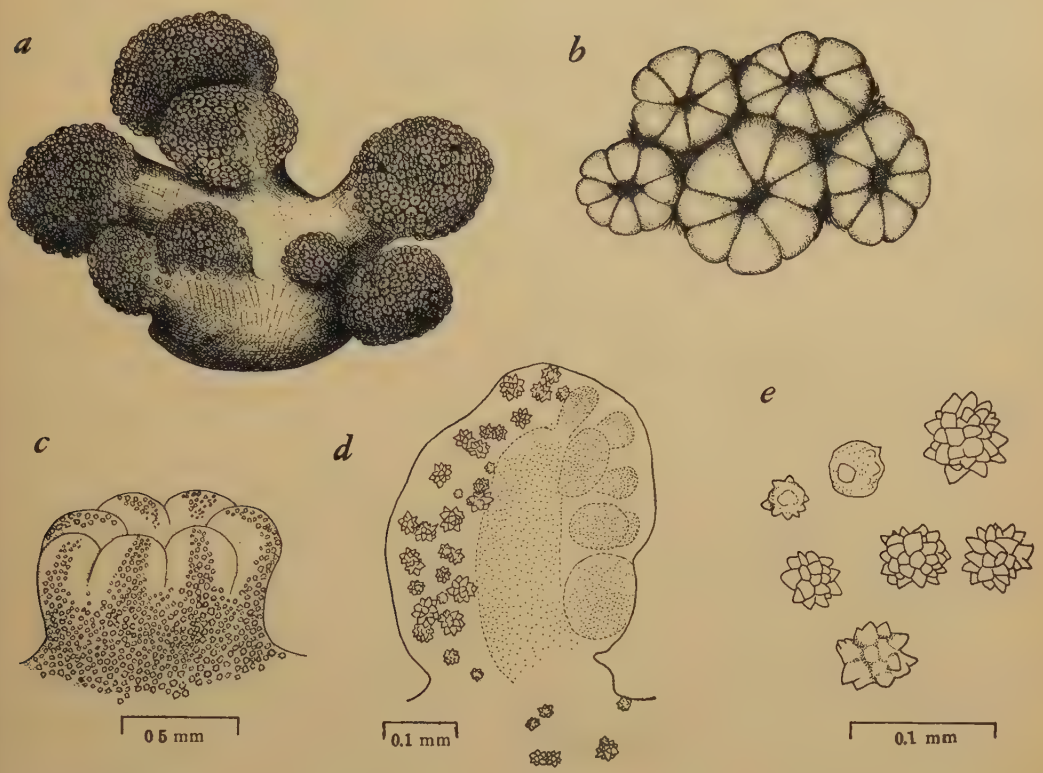


FIG. 1. *Asterospicularia laurae* n. gen. et n. sp.: *a*, holotype; *b*, five polyps, enlarged, showing the crown of contracted tentacles; *c*, lateral view of polyp, showing the arrangement of spicules; *d*, section of tentacle with spicules on aboral side only; *e*, stellate spicules and derivatives.

to be merely the branch of the coelenteron and not the contracted pinnules.

The spicules (Fig. 1*e*) are stellate, exceptionally roughened spherules without any distinct process. They are distributed uniformly in the mesogloea of the coenenchyma, polyp wall, oral disc, and the aboral side of the tentacles. They measure about 0.03–0.05 mm. in average diameter and, as in most alcyonarians, are composed of calcium carbonate with a sparse organic matrix. This stellate spicule, which reminds one of the sphaeraster of the tetraxonid sponges or the stellate spicule of the didemnid ascidians, is unique in the group Alcyonaria, and it is quite different from the spicules found in other forms.

## INTERNAL ANATOMY

For histological examinations, parts of the specimen were sectioned after decalcification in dilute acids. Because of poor staining, examination of the minor histological details was not possible.

The cross section of the main branch of the colony shows numerous lacunae of various sizes. The large lacunae are the direct continuations of the coelenteron of the principal polyps, while the smaller ones are the mesogloeal lacunae in the coenenchyma. The majority of the coenenchyma between the polyp bodies is strongly honeycombed by mesogloeal lacunae, which harbor spicules.

These honeycombed lacunae formed in the mesogloea are distinctly circumscribed and

are mostly circular or oval to oblong in outline, as shown in Figures 2*a–d*. Each of these lacunae is beset with 1 to 8, rarely up to 10, stellate spicules, the number varying according to the size of each lacuna. In most other alcyonarians, however, the mesogloea is more or less compact and is beset, either densely or loosely, with spicules. Each spicule originates from a single scleroblast of ectodermal origin, so that the space or cavity for a spicule is closely fitted to the form of the spicule contained in it (Koch, 1878; Hickson, 1895; Woodland, 1905; Bock, 1938). In this alcyonarian, the spicular cavity is constant in form, irrespective of the number of spicules contained. Though I made no actual observations on the development of the spicules, there is no evidence in my preparations of the presence of a number of spicules in a single cavity originating from a single spicule-forming cell or scleroblast.

The body wall of the anthocodia is composed of three layers—an outer rather thick ectodermal layer, a very thick mesogloeal layer, and an inner endodermal layer. Of these, the mesogloea is divided into two layers—the outer layer (with large lacunae containing spicules) which lines the epidermis and the inner layer with smaller empty lacunae (Fig. 2*a*). The inner layer surrounding the coelenteric cavity forms a homogeneous fleshy mass scattered with free mesogloeal cells which are endodermal in origin. These cells are rather large, measuring 4 to 10$\mu$ in diameter, and contain darkly stained oval or spindle-shaped nuclei. It is highly probable that these mesogloeal cells of endodermal origin are the direct continuations of the endodermal cell-strings or canals (i. e., solenia) or their derivatives. Their function is probably to give nutrition to, and to perform excretion from, the mesogloea, as suggested by Hickson (1895), Pratt (1903, 1905), Bock (1938), and Gohar (1940*b*). No mesogloeal cell of ectodermal origin suggesting a nerve plexus could be traced.

The epidermis is coated with a thin outer cuticle and is rather thick. It occupies the area between the outer cuticle and the outer layer of the spicular cavities of mesogloea. Its basal lining is indistinct, since the outer contour of the superficial mesogloea containing the larger spicular cavities is very irregular. Thus the thickness of the epidermis is considerably varied in different parts of the body. As far as I have observed on the decalcified preparations, the epidermis appears to be formed of more than one layer of ectodermal cells. All these cells are irregularly arranged, and the ordinary supporting and interstitial cell layers cannot be distinguished. Also I have seen no nematocysts or mucous gland cells in the epidermis.

The mouth leads into a very short stomodaeum which penetrates deep into the coelenteron. The stomodaeum is lined internally by a thick columnar epithelium and is provided on the ventral side with the siphonoglyphe. In the stomodaeal region, the mesenteries have thickenings (the so-called muscle banners) on the ventral side situated closer to the stomodaeum than to the coelenteric wall. Further details of the structure of the mesenteric filaments could not be traced. All the mesenteries appear very thin and run straight from the lower end of the stomodaeum down to the bottom of the coelenteron.

The endodermal cells of the coelenteric and tentacular cavities, together with zooxanthellae contained within them, are very loosely packed in the whole space and form an undefined mass. The boundaries between the endodermal cells are, however, slightly visible. Apparently these cells do not form any ordinary epithelial lining on the coelenteric walls such as is found commonly in ordinary coelenterates. In the lower part of the coelenteron, however, the endodermal cells are situated close to the wall and mesenteries.

The internal canal system is not so well developed as in the Alcyoniidae. The endodermal cell-strings or canals are seen most clearly near the surface of the coenenchyma; they take a sinuous or zigzag course in the

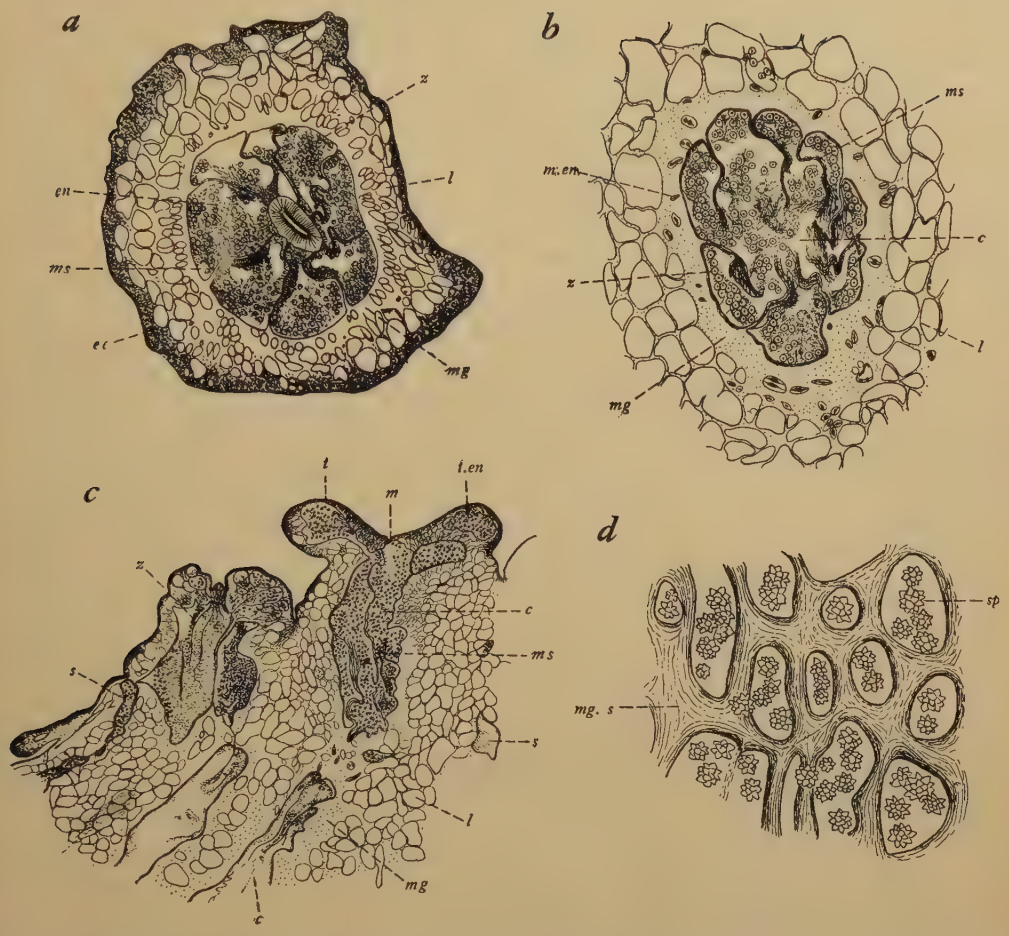


FIG. 2. *Asterospicularia laurae* n. gen. et n. sp.: *a*, transverse section of stomodaeal portion of polyp, ×85; *b*, transverse section of lower portion of polyp, ×135; *c*, longitudinal section of a part of coenenchyma with two polyps, ×50; *d*, superficial view of a part of coenenchyma, showing the arrangement of spicules, ×70. *a*-*c* from decalcified preparations and *d* from perfect specimen. (*c* coelenteron, *ec* ectoderm, *en* endoderm, *l* lacuna containing spicules, namely spicular cavity, *m* mouth, *mg* compact portion of mesogloea, *mg.s* mesogloeal partition between spicular cavities, *m.en* mesogloeal cell of endodermal origin, *ms* mesentery, *s* solenia, *t* tentacle, *t.en* tentacular branch of coelenteron, *z* zooxanthella.)

mesogloea between the spicular cavities and then communicate with the neighboring cavities. Usually they have no lumen, but contain granular endodermal cells and zooxanthellae similar to those found in the coelentera (Fig. 2*c*).

Zooxanthellae occur only in the endoderm, never in the ectoderm or in the mesogloea. They are most numerous in the tentacles and in the upper part of the coelentera between the mesenteries and solenia; they are found only sparsely in the deeper part. They are spherical and vary in diameter from 6 to 8$\mu$, the majority being 7.5$\mu$.

The stellate spicules, as mentioned above, occur only in the sharply circumscribed, rounded cavities of the honeycombed mesogloea. The number of spicules contained in each cavity varies greatly according to the size of the cavity. The mesogloeal partitions between these cavities, which are very thin and compact and which appear to be a homogeneous fibrous structure, contain no spicules at all (Fig. 2*d*).

REMARKS ON SYSTEMATIC POSITION

Before entering into a consideration of the systematic position of this remarkable alcyonarian, some historical remarks may not be amiss. It is interesting to note that there is good evidence that another specimen evidently referable to this form had been obtained and observed by two famous English workers on Alcyonaria 20 years ago. In an elaborate work on the alcyonarians collected by the Siboga Expedition (*Siboga-Expeditie*, XIIId, p. 219, pl. 21, fig. 8) issued in 1931, we find a short account by Sir Arthur J. Thomson and Miss Laura M. I. Dean (Mrs. L. M. I. Macfadyen) entitled, "Deceptive Fragments," as follows:

> Stat. 60. Haingsisi Reef. 1 Ex.
> Stat. 81. Sebangkatan, Borneo-Bank. 34M. Coral bottom and Lithothamnion. Several Ex.
>
> Several badly preserved fragments of a pronounced white colour, with a marked suggestion of shrunken *Alcyonium* or *Lobularia* colonies, and showing on some of the zooids eight tentacles (non-pinnate however), turn out to be compound Tunicates, not far removed from *Sarcodidemnoides*. The calcareous spicules, minute tuberculate spherules, are more refractive than those of Alcyonarians; as an instance of deceptive convergence we have figured a few.

This account and a sketch of spicules show quite decidedly that the so-called "deceptive fragment" was none other than a specimen of the present alcyonarian. It is small wonder that both authorities took it for a didemnid-like tunicate because of the peculiar shape of its spicules alone. In the group Alcyonaria, the form and arrangement of spicules constitute one of the most important characters of the genera and, often, of the species. They are usually represented by discs, rods, clubs, spindles, or capstans, all of which are simple, warty, or more complicatedly tuberculated or ramified. However, such distinctly star-shaped spicules resembling those in certain sponges and tunicates, as found in this *Asterospicularia*, are yet unknown in the Alcyonaria. In this respect, Hickson's opinion (1930: 230) that "The characters of the spicules are of great value in distinguishing the genera, and often of the species, but they are of little value in the division of the Alcyonaria into groups of higher rank," is not applicable to this case.

In this alcyonarian, the spicules are remarkably constant in form and size and are uniformly distributed in the mesogloea, except on the oral side of the tentacles, and do not form any special polyp armature. In this respect this species resembles more closely members of the Xeniidae than of any other family. However, it may be distinguished from the Xeniidae by the presence of spicules in the mesogloeal lacunae; for in the Xeniidae the spicules are confined to the ectodermal layer. The mesogloeal lacunae containing spicules are better developed than in the Alcyoniidae and Nephthyidae and are constant in form; moreover, the spicules in each lacuna are generally more than one in number. In the latter families, each lacuna is rather ill-defined and contains usually a single spicule almost similar to the outer contour of the lacuna.

In the mode of branching and in having numerous spicules scattered in the thick coenenchyma between the polyp cavities, this alcyonarian seems to be more closely related to the family Alcyoniidae and the genus *Capnella* of the Nephthyidae than to any other form, except that the mesogloea of the coenenchyma shows an unusually honeycombed structure as in that of the polyp body.

The coelenteron, which has scattered endodermal cells and zooxanthellae without forming any ordinary epithelial lining, seems to be rather peculiar. But the endodermal canal system seems to differ little from that of the Alcyoniidae.

The absence of pinnules in the tentacles is also characteristic, and is certainly noteworthy, since the pinnate tentacle is one of

the most important diagnostic characters of the group Alcyonaria, with the one exception of *Acrossota liposclera* (cf. Kükenthal, 1924). A remarkable pinnule-less alcyonarian, first recorded from Amboina by Burchardt (1898) as *Clavularia amboinensis*, was, in fact, an *Anthelia*. A second species, *Acrossota liposclera* described by Bourne (1914) as a new genus and new species, is, according to Thomson and Dean (1931), probably identical with Burchardt's *C. amboinensis*. In some alcyonarians —e.g., *Pachyclavularia erecta*, *Cespitularia stolonifera*, and others—examined by early authors and also by me, there are often found some highly contracted tentacles seemingly devoid of pinnules (cf. Thomson and Dean 1931: 20; Gohar 1940*a*: 5). It is possible that this condition is the result of bad preservation and contraction. The present *Asterospicularia* is obviously different from *Pachyclavularia*, *Cespitularia*, and other xeniid specimens, as mentioned above.

Taking into consideration all of the unique features of the specimen described above, it seems certain that it represents a new type of alcyonarian which shows a close affinity with the Alcyoniidae as well as with the Nephthyidae; but it cannot to be included in either family. Moreover, it also demands a modification of the definition of the group Alcyonaria or Octocorallia generally used in all handbooks and textbooks of zoology. Thus I think it necessary to erect a separate family, ASTEROSPICULARIIDAE, for this specialized form, which I propose to call *Asterospicularia laurae*,[2] n. gen. et n. sp.

The characteristics of the new family may be put down as follows:

ASTEROSPICULARIIDAE n. fam.

Fleshy Alcyonaria of bushy growth type, with mushroom-like, polyp-bearing lobes and a sterile common stalk. Polyps of similar size non-retractile and protected by uniform spiculation continued from coenenchyma. Coenenchyma rather thick between polyp cavities and formed of highly honeycombed mesogloea which contains one or more stellate spicules in each cavity. Polyp cavities united together by means of well-developed endodermal cell-strings or solenia running in mesogloeal partitions between spicular cavities. No dimorphism of polyps. Tentacles highly contractile, with no trace of pinnules.

TYPE: *Asterospicularia laurae*, n. gen. et n. sp.

[2]The specific name is chosen in honor of Mrs. Laura M. I. Macfadyen, who first recorded this form.

## REFERENCES


ASHWORTH, J. H. 1899. The structure of *Xenia hicksoni*, nov. sp., with some observations on *Heteroxenia elizabethae*, Kölliker. *Micros. Sci., Quart. Jour.* 42(2): 245–304, pls. 23–27.

BOCK, S. 1938. The alcyonarian genus *Bathyalcyon*. *Kungl. Svenska Vetensk. Handl.*, Tredje Ser., 16(5): 1–54, pls. 1–2.

BOURNE, G. C. 1914. On *Acrossota liposclera*, a new genus and species of alcyonarian with simple tentacles. *Micros. Sci., Quart. Jour.* 60(2): 261–272, pl. 22.

BURCHARDT, E. 1898. Alcyonaceen von Thursday Island (Torres Strasse) und von Amboina. *Semon's Zool. Forschungsreise Australia* 5: 431–442, 2 pls.

GOHAR, H. A. F. 1940*a*. A revision of some genera of the Stolonifera. *Mar. Biol. Sta. Ghardaqa (Red Sea), Pub.* No. 3: 1–23, pl. 1.

——— 1940*b*. The development of some Xeniidae (Alcyonaria). *Mar. Biol. Sta. Ghardaqa (Red Sea), Pub.* No. 3: 25–79, pls. 1–5.

HICKSON, S. J. 1895. The anatomy of *Alcyonium digitatum*. *Micros. Sci., Quart. Jour.* 37(3): 343–388, 4 pls.

——— 1930. On the classification of the Alcyonaria. *Zool. Soc. London, Proc.* 1930, No. 15: 229–252.

KOCH, G. VON. 1878. Mittheilungen über Coelenteraten. (D) Das Skelet der Alcyonarien. *Morph. Jahrb.* 4: 447–473, pls. 22–23.

KÜKENTHAL, W. 1924. Octocorallia. In: Kükenthal-Krumbach's *Handbuch der Zoologie*, I: 690–769.

PRATT, E. M. 1903. The mesogloeal cells of *Alcyonium*. (Prelim. acct.) *Zool. Anz.*, 25: 545–548.

——— 1905. The digestive organs of the Alcyonaria and their relation to the mesogloeal cell plexus. *Micros. Sci., Quart. Jour.* 49(2): 327–362, pls. 20–22.

THOMSON, J. ARTHUR, and LAURA M. I. DEAN. 1931. The Alcyonacea of the Siboga Expedition, with an appendum to the Gorgonacea. *Siboga-Expeditie*, mon. 13d, livr. 115, 227 pp., 28 pls.

WOODLAND, W. 1905. Studies in spicule formation. Pt. II. Spicule formation in *Alcyonium digitatum*, with remarks on the histology. *Micros. Sci., Quart. Jour.* 49(2): 283–304, pls. 16–17.

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Edited by Dr. Tokubei Kuroda

June 15, 1951 | Pectinidae | No. 13.

# 日本産ツキヒガヒ亞科

大 山 桂

# Amusiinae in Japan

by

Katura Oyama

## Amusiinae ツキヒガヒ亞科

*Ctenamusium* Iredale, 1929. クマドリツキヒガヒ屬

1929 *Ctenamusium* Iredale, Rec. Austr. Mus., Vol. 17, No. 4, p. 164.

Type species: *Amussium thetides* Hedley (original designation).

*Bathyamussium* new subgenus. ハナヤカツキヒガヒ亞屬

Type species: *Amussium jeffreysii* E. A. Smith. (original designation).

Shell of moderate size, thin, ovate, with byssal sinus. Surface sculpture of the left valve with numerous small radial striations on the nepionic area, but becoming cancellate (dominant concentric lamellae) with age.

Remarks: this new subgenus is more or less intermediate between *Ctenamusium* and *Variamussium*. The shape and sculpture is more like that of *Variamussium*, but the presence of the byssal sinus suggests that it should be placed in *Ctenamusium*.

1. *Ctenamusium* (*Bathyamussium*) *jeffreysii* (E. A. Smith). ハナヤカツキヒガヒ

Pl. 13, figs. 1, 2.

1885 *Amussium jeffreysii* E. A. Smith, Challenger Rep., Vol. 13, No. 1, p. 310, pl. 23, figs. 2, 2a-c.

Length 19.7mm., height 20.6mm., breadth 3mm. (figured specimen collected at Gulf of Tosa).

Type locality: Philippine Islands.

Distribution: Indian Ocean; Philippine Islands and Shikoku, Japan.



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(Shirahama, Wakayama-ken, Japan)
Contribution No. 164

Ctenamusiums. str. クマドリツキヒガヒ亞屬

2. *Ctenamusium* (*Ctenamusium*) *cmadoritinctum* (Kuroda) クマドリツキヒガヒ

Pl. 13, figs. 3, 4.

1931 *Propeamusium cmadoritinctum* Kuroda, Venus, Vol. 2, No. 6, App. p. 72, figs. 81, 82.

1931 *Propeamusium* (*scitulum* Smith var.?) *cmadoritinctum* Kuroda, id., Vol. 3, No. 1, App. p. 77.

Length 8.3mm., height 8.0mm., breadth 1.6mm. (figured specimen collected at Yakushima by the late Y. Hirase.)

Type locality: Yakushima, Kyushu.

*Micramussium* new subgenus. シラタマツキヒガヒ亞屬

Type species: *Ctenamusium* (*Micramussium*) *siratama* new species.

Shell small, rounded, vitreous white. Auricles almost similar in shape. Surface of the left valve ornamented with very fine radial striations on the nepionic area, but becoming smooth with age.

Remarks: This new subgenus is characterized by small size, circular outline and its sculpture.

3. *Ctenamusium* (*Micramussium*) *siratama* new species. シラタマツキヒガヒ

Pl. 13, figs. 5, 6, 7.

Shell small, thin, rather circular, almost equilateral and nearly equivalves. Auricles comparatively small, subtriangular, but antero-and postero-dorsal corners are fairly rounded; hinge margins of the auricles straight and crenulated. Surface almost smooth, but the detailed sculpture of the two valves is microscopically different. The left valve having numerous fine radial striations, which are more or less distinct near the umbo, especially on the auricles they are more distinct. Internal lirae ten in number, both outermost ones situating on the base of the auricles; other lirae are somewhat stronger and with rounded ends; each lirae begining from the beak cavity reaching close to the ventral margin. The left valve being pellucid white; the right fawn-colour; and the both valves showing through the internal lirae as white lines. Inside of both valves with brilliantly vitreous gloss.

Length 7.5mm., height 7.4mm., breadth 2.8mm. (figured type specimen)

Type locality: Off Manazuruzaki, Sagami Sea, (159—128 fms.)

*Parvamussium* Sacco, 1897. オボロツキヒガヒ屬

1897 *Parvamussium* Sacco, Boll. Mus. Zool. Anat. Comp., Univ. Torino, Vol. 12, p. 101.

Type species: *Pecten duodecim-lamellatus* Bronn (original designation).

*Parvamussium* s. str. オボロツキヒガヒ亞屬

4. *Parvamussium* (*Parvamussium*) *rubrotinctum* new species. オボロツキヒガヒ

Pl. 13, figs. 8, 9, 10.

Shell of moderate size, thin, ovate, compressed, subequilateral, subequivalves; ventral margin thin and fragile with weak deposit of shell substances; anterior margin rounded; posterior margin weakly produced towards the postero-ventral part. Auricles small, anterior one larger than the posterior; anterior margin of the anterior auricle nearly vertical to the dorsal mardin, while the posterior end of the hinge margin bluntly angulated to the posterior margin of the auricle. The hinge margin straigt, with indistinct crenations; byssal sinus poorly developed. Surface of the left valve smooth, some indistinct concentric undulations are visible only; the right valve ornamented with distinct regular concentric ribs and also a single radial rib on the base of the anterior auricle. Internal lirae 18 in the left valve with additional shorter intercalated ones; in the right valve the number being 12 including some shorter ones. The coloration differs in both valves: ground colour of the left valve is pale pellucid amber, tinted with fleshy apricot orange, in addition the white rays of the internal lirae are visible through it; that of the right valve is pale orange apricot, with milky white rays are visible in same way.

Length 16.8mm., height 16.3mm., breadth 4mm. (figured specimen)

Type locality; Gulf of Tosa, Shikoku.

Distribution: Shikoku and Kyushu.

Remark: internal lirae of the left valve of the holotype are extra-rodinarily 18 in number but in many specimens they are generally 12.

*Flavamussium* new subgenus. ワタゾコツキヒガヒ亞屬

Type species; *Amussium caducum* E. A. Smith (original designation).

Shell of moderate size, ovate, equilateral, with almost equal auricles. Surface of the left valve smooth.

Remark: this new subgenus is nearly equilateral with equal auricles, while *Parvamussium* s. str. is rather inequilateral with unequal auricles.

5. *Parvamussium* (*Flavamussium*) *caducum* (E. A. Smith) ワタゾコツキヒガヒ

Pl. 13, figs. 11, 12.

1885 *Amussium caducum* E. A. Smith, Challenger Rep., Vol. 13, No. 1, p. 309, pl. 23, figs. 1, 1a-c.

1932 *Propeamussium nakazawai* Kuroda, Venus, Vol. III, No. 2, app. p. 87, figs. 101, 102. (name and figures only).

Length 22.9mm., height 25.0 mm. breadth 6mm. (figured specimen from Gulf of Suruga).

Type locality: Philippine Islands.

Distribution: Pilippine Islands; Shikoku and Honshu, Japan.

Remarks: the type specimen seems either abnormal, or the figure was not drawn accurately.

*Luteamussium* new genus. クラゲツキヒガヒ屬

Type species: *Amussium Sibogai* Dautzenberg et Bavay (original designation)

Shell of moderate size, rounded, subequilateral. Auricles very small, nearly equal in size. Surface nearly smooth. Internal lirae the strongest among the known Amusiinae.

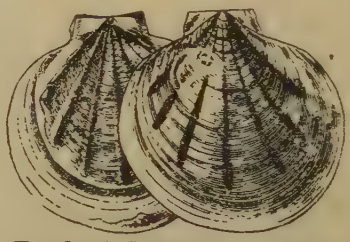
Remark: this new genus is chracterized by larger size, circular outline and its internal lirae subangulately terminated.

6. *Luteamussium sibogai* (Dautzenberg et Bavay) クラゲツキヒ

Textfig. 1.

1904 *Amussium Sibogai* Dautzenberg et Bavay, Journ. de Conchyl., Tom. 52, p. 207, textfigs. 1-4.

1912 *Amussium Sibogai* Dautzenberg et Bavay, Siboga Exped., Monogr. 52 b. (Pectens), p. 31, pl. 28, figs. 1-4.



Textfig. 1. *Luteamussium sibogai* (Dautzenberg et Bavay), (after Illust. Encycl. Fauna Japan 1947).

Length 38.0mm., height 37.0mm., (figured specimen collected at Gulf of Tosa).

Type locality: Bali Sea, East Indies.

Distribution: East Indies; Kyushu and Shikoku.

## Explanation of Plate 13. 第13圖版說明

Figs. 1, 2. *Ctenamusium* (*Bathyamussium*) *jeffreysii* (E. A. Smith) ハナヤカツキヒ, 1. right valve (margin broken), 2. left valve of same specimen. 19.7×20.6×3mm. p. 79.

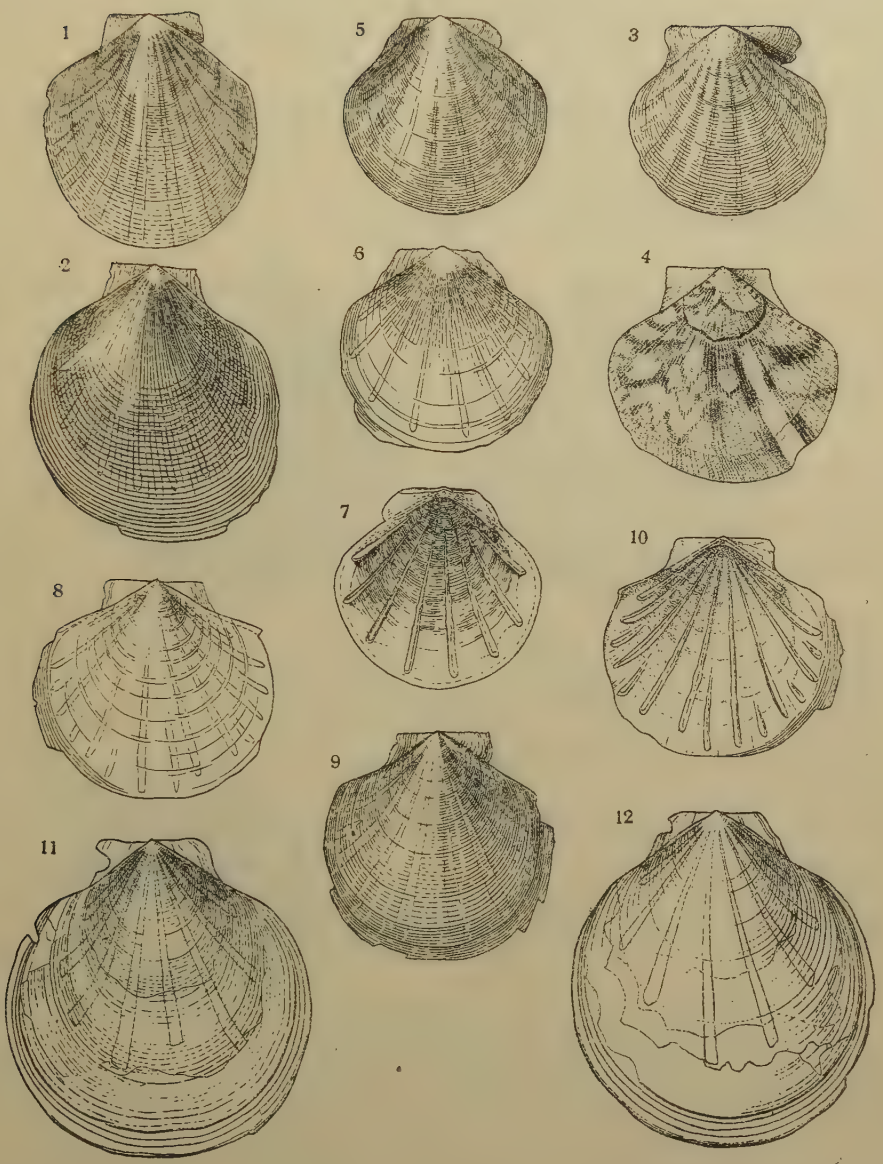
3, 4. *Ctenamusium* (*Ctenamusium*) *cmadoritinctum* (Kuroda) クマドリツキヒ, 3. right valve (margin broken), 4. left valve of some specimen. 9.3×8.0×1.6mm. p. 80.

5, 6, 7. *Ctenamusium* (*Micramusium*) *siratama* new species シラタマツキヒ, 5. right valve (margin broken), 6. left valve of same specimen. 7. inside of right valve. 7.5×7.4×2.8mm. p. 80.

8, 9, 10. *Variamussium* (*Flavamussium*) *rubrotinctum* new species オボロツキヒ, 8. left valve (margin somewhat broken), 9. right valve of same specimen, 10. inside of left valve. 16.8×16.3×4mm. p. 81.

11, 12. *Variamussium* (*Flavamussium*) *caducum* (E. A. Smith) ワタソコツキヒ, 11. right valve, 12. left valve of same specimen. 22.9×25.0×6mm. p. 81.

Plate 13. Amusieina




Yoshida, del.

*Amusium* Röding, 1798. (*Amussium*) ツキヒガヒ屬

1798 *Amusium* Röding, Mus. Bolten., p. 165.

Type species: *Ostrea pleuronectes* Linné (designated by Herrmannsen, 1846)

8. *Amusium japonicum* (Gmelin) ツキヒガヒ

Textfigs. 2, 3.

1791 *Ostrea japonica* Gmelin, Syst. Nat., (ed. 13), p. 3371.

1852 *Pecten japonicus* Reeve, Conch. Icon., sp. 47.

Length 121mm., height 121mm., breadth 27.1mm. (figured specimen collected at Okinoshima, Tosa).

Type locality: Japan.

Distribution: Honshu, Shikoku and Kyushu.

Textfigs. 2, 3. *Amusium japonicum* (Gmelin) ツキヒガヒ

9. *Amusium pleuronectes* (Linné) タカサゴツキヒガヒ

Textfig. 4.

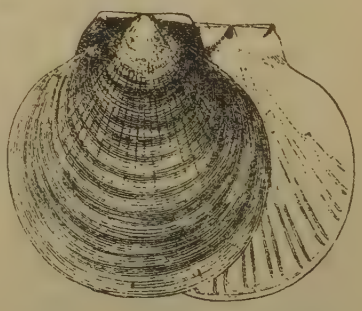
1758 *Ostrea pleuronectes* Linné, Syst. Nat., (ed. 10), p. 696.

1852 *Pecten pleuronectes* Reeve, Conch. Icon., sp. 48.

Length 66.0mm., height 70.0mm., breadth 13.0mm. (figured specimen collected at Takao, Taiwan).

Type locality: Indies.

Distribution: Southeastern Asia, Taiwan. (=Formosa)



Textfig. 4. *Amusium pleuronectes* (Linné), タカサゴツキヒ (after Illust. Encycl. Fauna Japan 1947).

List of the marine molluscan genera, subgenera and sections (Tertiary to Recent) established by the Japanese authors (1925—1949). (No. 4)

*66. *Shichiheia* Hatai et Nisiyama 1949, Jour. Paleont., vol. 23, no. 1, p. 93 (Orthotype: *Shichiheia etchuensis* Hatai et Nisiyama) (Tonnidae).

67. *Sinuatodostomia* Nomura 1937 (as a subgenus of *Odostomia* Fleming 1817). Saito Ho-on Kai Mus. Res. Bull., no. 13, p. 23 (Orthotype: *Odostomia sinuosa* Nomura) (Pyramidellidae).

68. *Siogamaia* Nomura 1936 (as a subgenus of *Tropaeas* Dall et Bartsch 1904), Saito Ho-on Kai Mus. Res. Bull., no. 10, p. 49 (Orthotype: *Tropaeas* (*Siogamaia*) *fortiplicata* Nomura) (Pyramidellidae).

*69. *Siratoria* Otuka 1937, Jap. Jour. Geol. Geogr., vol. 14, p. 30 (Orthotype: "*Paphia*" *siratoriensis* Otuka) (Veneridae).

70. *Solidicorbula* Habe 1949, Illust. Cat. Jap. Shells, no. 1, p. 2 (Orthotype: *Corbula erythrodon* Lamarck) (Erodonidae).

71. *Sphaerassiminea* Habe 1942 (as a section of *Assiminea* Fleming 1828), Venus, vol. 12, nos. 1–2, pp. 42–43 (Haplotype: *Assiminea* (*Sphaerassiminea*) *brevicula* (Pfeiffer)) (Assimineidae).

72. *Squamamussium* Oyama 1944 (as a subgenus of *Propeamussium* De Gregorio 1884), Jap. Jour. Malac., vol. 13, nos. 5–8, pp. 244, 245 (Orthotype: *Amussium squamigerum* E. A. Smith) (Pectinidae).

73. *Subcuthona* Baba 1949, Opisthobranchia of Sagami Bay, pp. 100, 176 (Orthotype: *Subcuthona pallida* Baba) (Tergipedidae).

*74. *Suchium* Makiyama 1925, (as a subgenus of *Umbonium* Link 1807), Jap. Jour. Geol. Geogr., vol. 3, p. 128 (Orthotype: *Umbonium* (*Suchium*) *suchiense* Yokoyama) (Trochidae).

*75. *Tateiwaia* Makiyama 1936 (as a subgenus of *Batillaria* Benson 1842), Mem. Coll. Sci. Kyoto Imp. Univ. ser. B. vol. 11, no. 4, p. 219 (Orthotype: *Batillaria* (*Tateiwaia*) tateiwai Makiyama) (Potamidae).

76. *Teramachia* Kuroda 1931, Venus, vol. 3, no. 1, pp. 45–47 (Haplotype: *Teramachia tibiaeformis* Kuroda) (Volutidae).

77. *Tibatrochus* Nomura 1940 (a synonym of *Mirachelus* Woodring 1928), Rec. Oceanogr. Works Japan, vol. 2, no. 1, p. 103 (Haplotype: *Tibatrochus husaensis* Nomura) (Trochidae).

78. *Tristichotrochus* Ikebe 1941 (as a subgenus of *Calliostoma* Swainson 1840), Venus, vol. 11, nos. 2–3, p. 55. (Orthotype: *Calliostoma aculeata* Sowerby) (Trochidae).

79. *Varicinassa* Habe 1946 (as a subgenus of *Nassarius* Dumeril 1806), Jap. Jour. Malac., vol. 14, nos. 5–8, p. 193 (Haplotype: *Nassarius* (*Varicinassa*) *varicifera* (A. Adams)) (Nassariidae).

80. *Vermitoma* Kuroda 1928, Cat. Shell Moll. Amami-Oshima, p. 40 (Haplotype: *Vermitoma luchuana* Kuroda) (Vermetidae).

81. *Vicaryella* Yabe et Hatai 1938, Sci. Rep. Tohoku Imp. Univ., ser. 2, vol. 19, no. 2, pp. 166–167 (Orthotype: *Vicaryella tyosenica* Yabe et Hatai) (Potamidae)

82. *Xenamussium* Oyama 1944 (as a subgenus of *Propeamussium* De Gregorio 1884), Jap. Jour. Malac., vol. 13, nos. 5–8, pp. 244–245 (Orthotype: *Pecten hoskynsi* Forbes) (Pectinidae).

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**Nomenclatorial notes**

Following new terms are required from their invalid names:

*Trifaricardium* (gen. nov.) *nomurai* nom. nov., for *Cardium cancellata* Nomura 1933 (Sci. Rep. Tohoko Imp. Univ., (2) 16 (1), p. 81, pl. 3, figs. 9a, b) non Gmelin 1791.

*Venericardia* (*Pleuromeris*) *Pygmaea* nom. nov., for *Cardita abbreviata* Sowerby 1903 (Ann. Mag. Nat. Hist., (7) 12, p. 500) non Conrad 1841.

*Felaniella sowerbyi* nom. nov., for *Felania minor* Sowerby 1903, (Ann. Mag. Nat. Hist., (7) 12, p. 500) non Dall 1900.

*Thyasira tokunagai* sp. nov., for *Thyaira gouldii* Yabe et Nomura 1925 (Sci. Rep. Tohoku Imp. Univ., (2) 2 (4), p. 94, pl. 23, figs. 6a, b) non Philippi 1845.

*Anomalocardia* (*Cryptonemella* nom. nov) *producta* nom. nov., for *Venus impressa* Anton 1837 (Archiv f. Naturges., 3 (1), p. 284) non des Serres 1827, and *Cryptonema* Jukes-Browne 1914 (Proc. Malac. Soc. London, 11, p. 80) non Bigsby 1868.

*Julia* (*Prasina*) *japonica* sp. nov., for *Julia exquisita* Kuroda 1935 (Venus 5 (4), App. p. 145, textfigs. 146, 147) non Gould 1862.

(Tokubei Kuroda and Tadashige Habe)

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# 日本産エゾタマキビガヒ科 (1)

波 部 忠 重

# Littorinidae in Japan (1)

by
Tadashige HABE

Family Littorinidae エゾタマキビガヒ科

Genus *Littorina* Blainville 1825 エゾタマキビガヒ屬

1825 *Littorina* Blainville, Faune Francaise, Malacozoaires, p. 297.

1918 *Argaroda* Dall, Proc. Biol. Soc. Washington, **31**, p. 137.

Type species: *Turbo littoreus* Linné (designated by Blainville 1828).

1. *Littorina squalida* Broderip et Sowerby エゾタマキビガヒ

Pl. 14, fig. 6

1829 *Littorina squalida* Broderip et Sowerby, Zool. Jour., **4**, p. 370.

1846 *Litorina squalida* Philippi, Abbild. Beschr., **2**, p. 101, fig. 1, pl. 6.

1848 *Ltttorina grandis* Middendorff, Bull. phys. mathem. Acad. Imp. Sci. St. Petersburg, **7** (16), p. 241.

Length 27.8mm., breadth 24.3mm. (figured specimen collected from the Akkeshi Bay, Hokkaido).

Type locality: New Zealand (erroneously recorded).

Distribution: Kurile Islands; Saghalien; Hokkaido.

Genus *Littorivaga* Dall 1918 マルタマキビガヒ屬

1918 *Littorivaga* Dall, Proc. Biol. Soc. Washington, **31**, p. 137.

Type species: *Littorivaga sitkana* Philippi (monotypy)

2. *Littorivaga sitkana* (Philippi) マルタマキビガヒ

Text-fig. 4.

1846 *Littorina sitkana* Philippi, Proc. Zool. Soc. London, **13**, p. 140. (1945)

1847 *Litorina sitchana* Philippi, Abbild. Beschr., **3**, p. 49, pl. 6. figs. 13, 18.



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1848 *Littorina kurila* Middendorff, Bull. phys. mathem. Acad. Imp. Sci. St. Petersburg, **7**, p. 242.

1848 *Littorina subtenebrosa* Middendorff, *l. c.*, p. 242.

Length 13.2mm., breadth 11.4mm., (examined specimen collected from Hokkaido).

Type locality: Sitka, Aleutian Islands.

Distribution: Northern Pacific; Kurile Islands; Tobishima in the Japan Sea.

### 3. *Littorivaga brevicula* (Philippi) タマキビガヒ

Pl. 14, figs. 15, 17, 18.

1844 *Turbo* (*Littorina*) *brevicula* Philippi, Zeitschr. f. Malac., p. 166.

1847 *Litorina brevicula* Philippi, Abbild. Beschr., **2**, (6), pl. 3, fig. 10.

1850 *Littorina castanea* Adams et Reeve, Moll. Voy. Samarang, p. 49, pl. 11. fig. 8.

1857 *Littorina balteata* Reeve, Conch. Icon., sp. 71.

1862 *Littorina souverbiana* Crosse, Jour. de Conchyl., **10**, p. 53, pl. 1, fig. 6, 7.

Length 13.8mm., breadth 12.5mm. (examined specimen collected from the Ago Bay, Mie Pref.).

Type locality: The mouth of Yangtse-kiang, China.

Distribution: China; Formosa; Kyushu, Shikoku, Honshu and Hokkaido.

Text-figs. 1—4. 1. *Tectariusgrandinatus* (Gmelin) イガタマキビ,
2. *Littorivaga mandschurica* (Schrenck) アツタマキビ×1⅓,
3. *Littorivaga aleutica* (Dall) ヒロクチタマキビ (after Dall 1902),
4. *Littorivaga sitkana* (Philippi) マルタマキビ (after Dall 1925).

### 4. *Littorivaga atkana* (Dall) クロタマキビガヒ

Pl. 14, figs. 2, 9.

1886 *Littorina atkana* Dall, Proc. U. S. Nat. Mus., **9**, p. 211.

1902 *Littorina atkana* Dall, Proc. U. S. Nat. Mus., **24**, (1264), p. 551, pl. 39, fig. 11.

Length 13.5mm., breadth 11.5mm. (figured specimen collected from the Akkeshi Bay, Hokkaido).

Type locality: Bering Islands.

Distribution: Northern Pacific; Kurile Islands; Hokkaido.

5. *Littorivaga mandschurica* (Schrenck) アツタマキビガヒ

Pl. 14, fig. 10, Text-fig. 2.

1861 *Littorina mandschurica* Schrenck, Bull. Acad. Imp. Sci. St. Petersburg, **4**, p. 409.

1867 *Littorina mandschurica* Schrenck, Reise Forsch. Amur-lande, p. 333. pl. 14, figs. 14—20.

Length 15.5mm., breadth 15.0mm. (figured specimen collected from Teshio, Hokkaido).

Type locality: Castries Bay, Siberia.

Distribution: Siberia; Saghalien; Hokkaido.

6. *Littorivaga aleutica* (Dall) ヒロクチタマキビガヒ

Text-fig. 3.

1872 *Littorina aleutica* Dall, Proc. California Acad. Sci., **4**, p. 271, pl. 1, fig. 3.

1902 *Littorina aleutica* Dall, Proc. U. S. Nat. Mus., **24** (1264), p. 551, pl. 39, figs. 4, 6.

Length. 41 in., breadth. 53 in. (after Dall).

Type locality: Gull Rocks, Akutan Pass, Aleutian Islands.

Distribution: Aleutian Islands; Kurile Islands.

Genus *Tectarius* Valenciennes 1833 イガタマキビガヒ屬

1833 *Tectarius* Valenciennes, in Humboldt and Bonpland. Voy. Reg. Equin Nouv. Contin, pt. 2, **2**, p. 271.

1840 *Echinella* Swainson, Treat. Malac., p. 352 (non Bory de St. Vincent 1824)

1899 *Echinellopsis* Roverto, Atti Soc. Ligustica, **10**, p. 109.

Type species: *Tectarius coronatus* Valenciennes (monotypy)

7. *Tectarius grandinatus* (Gmelin) イガタマキビガヒ

Text-fig. 1.

1791 *Trochus grandinatus* Gmelin, Syst. Nat., ed 13, p. 3585.

1846 *Litorina papillosa quadriseriata* Philippi, Abbild. Beschr., **2** (4), p. 140, pl. 2, fig. 2.

1941 *Tectarius* (*Echinellopsis*) *grandinatus* Kuroda, Mem. Fac. Sci. Agr. Taihoku Imp. Univ., **22** (4), p. 83, pl. 1, fig. 3.

Length 10.8mm., breadth 8.1mm. (figured specimen collected from Kosyun, Formosa by Dr. Kuroda).

Type locality: Palmerstoni Insulam.

Distribution: South-Western Pacific Region; Formosa.

Genus *Echininus* Clench et Abbott 1942 コンペイトウガヒ屬

1850 *Nina* Gray, Fig. Moll. Anim. London, **4**, p. 78 (non Horsfield 1829)

1942 *Echininus* Clench et Abbott, Johnsonia, **1**, (4), p. 3.

Type species: *Trochus cumingii* Philippi (original designation)

8. *Echininus cumingii* (Philippi) コンペイトウガヒ

Pl. 14, figs. 13, 14.

1846 *Trochus cumingii* Philippi, Proc. Zool. Soc. London, **13**, p. 138.
1847 *Litorina cumingii* Philippi, Abbild. Beschr. **3**, p. 53, pl. 6, fig. 22.
1901 *Echinella cumingii luchuana* Pilsbry, Proc. Acad. Nat. Sci. Phila., **53**, pp. 198, 394, pl. 19, fig. 16.

Length 13.0mm., breadth 11.4mm. (figured specimen collected from Tokunoshima, Amami group).

Type locality: Guimaras, Philippines.

Distribution: Philippines; Formosa; Ryukyu and Amami groups.

Genus *Nodilittorina* von Martens 1897 イボタマキビガヒ屬

1897 *Nodilittorina* von Martens, Zool. Ergebnisse Reise Niederlandisch Ostindien, **4**, p. 204.

Type species: *Turbo tuberculatus* Wood (=*Turbo trochiformis* Dillwyn =*Trochus nodulosus* Gmelin). (designated by Wenz 1939)

9. *Nodilittorina vilis* (Menke) イボタマキビガヒ

Pl. 14, figs. 11, 12.

1846 *Litorina vilis* Menke Abbild. Beschr., **2** (5), p. 145. pl. 2, fig. 21.
1847 *Litorina malaccana* Philippi, *l. c.*, **3**, p. 51, pl. 6, fig. 17.
1851 *Echinella cecillei* Philippi, Zeitschr, f. Malak., p. 78.
1897 *Littorina vilis* v. Martens, Zool. Ergebnisse Reise Niederlandisch Ostindien, **4**, p. 204.

Length 12.3mm. breadth 7.0mm. (examined specimen from Suo, Formosa by T. Kuroda).

Type locality: ————————.

Distribution: South-Western Pacific Region; Formosa to Honshu.

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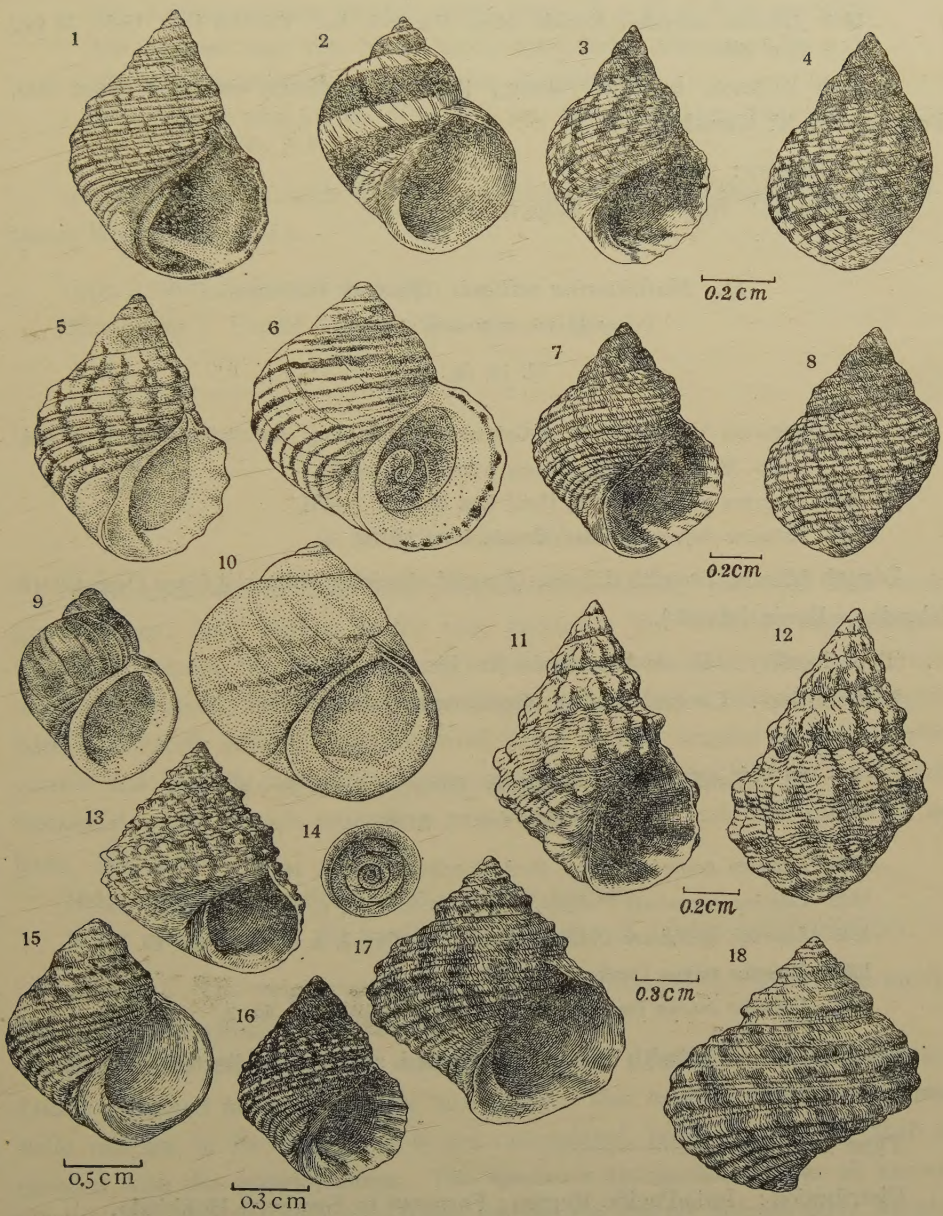
Explanation of Plate 14. 第 14 圖 版 說 明

Fig. 1. *Nodilittorina subnodosa* (Philippi) カスリタマキビ, 10.0mm.×7.0mm.
2. *Littorivaga atkana* (Dall) クロタマキビ, 17.0mm.×13.5mm. (Paratype specimen collected from Kyska Id., Alaska by Dall).
3, 4. *Nodilittorina picta* (Philippi) タイワンタマキビ, from Shirahama, Wakayama Pref.
5. *Nodilittorina miliaris* (Quoy et Gaimard) ヲガサハラタマキビ, 8.9mm.×6.3mm.
6. *Littorina squalida* Broderip et Sowerby エゾタマキビ, 27.8mm.×24.3mm.
7, 8, 16. *Nodilittorina granularis* (Gray) アラレタマキビ, from Shirahama, Wakayama Pref.
9. *Littorivaga atkana* (Dall) クロタマキビ, 15.5mm.×11.5mm.
10. *Littorivaga mandschurica* (Schrenk) アツタマキビ, 15.5mm×15.0mm.
11, 12. *Nodilittorina vilis* (Menke) イボタマキビ, from Shirahama, Wakayama Pref.
13, 14. *Echininus cumingii* (Philippi) コンペイトウガヒ, 13.0mm.×11.4mm.
15, 17, 18. *Littorivaga brevicula* (Philippi) クマキビ, from the Kojima Bay, Okayama Pref.

Plate 14. Littorinidae



10. *Nodilittorina subnodosa* (Philippi) カスリタマキビガヒ

Pl. 14, fig. 1.

1847 *Litorina subnodosa* Philippi, Abbild. Beschr., **2** (6), p. 161, pl. 3, figs 8, 9.

1897 *Littorina subnodosa* v. Martens, Zool. Ergebnisse Reise Niederlandisch Ostindien, **4**, p. 205.

1941 *Littorina subnodosa* Kuroda, Mem. Fac. Sci. Agr. Taihoku Imp. Univ., **22** (4), p. 205.

Length 10.0mm,, breadth 7.0mm., (figured specimen collected from Suo, Formosa by T. Kuroda).

Type locality: Red Sea.

Distribution: Indo-Pacific Region; Formosa.

11. *Nodilittorina miliaris* (Quoy et Gaimard)
ヲガサハラタマキビガヒ

Pl. 14, fig. 5.

1833 *Littorina miliaris* Quoy et Gaimard, Urville Voy. Astrolabe, Zool. **2**, p. 484, pl. 33, figs. 16—19.

1844 *Littorina miliaris* Nevill, Hand List Moll. **2**, p. 154.

1857 *Littorina feejeensis* Reeve, Conch. Icon., sp. 82.

Length 8.9mm., breadth 6.3mm. (figured specimen collected from Ogasawara Islands (=Bonin Islands).

Type locality: Ilè de l'Ascensin (Pacific fide Nevill)

Distribution: Central Pacific; Ogasawara Islands.

12. *Nodilittorina granularis* (Gray) アラレタマキビガヒ

Pl. 14. figs. 7, 8, 16.

1839 *Littorina granularis* Gray, Zool. Beechey's Voy, p. 140.

1848 *Litorina granularis* Philippi, Abbild. Beschr., **3**, p. 63. pl. 7, fig. 7.

1848 *Litorina millegrana* Philippi, Abbild. Beschr., **3**, p. 65, pl. 7 fig. 15.

1860 *Littorina exigua* Dunker, Mal. Bl., **6**, p. 226.

1861 *Littorina exigua* Dunker, Moll. Japonica, p. 13. pl. 2, fig. 3.

Length 9.0mm., breadth 7.5mm. (examined specimen collected from Shirahama, Wakayama Pref.).

Type locality: ————————.

Distribution: Indo-Pacific Region; Formosa to Southern Hokkiado.

13. *Nodilittorina picta* (Philippi) タイワンタマキビガヒ

Pl. 14. figs. 3, 4.

1846 *Littorina picta* Philippi, Proc. Zool. Soc. London, 13, p. 139 (1945).

1847 *Litorina picta* Philippi, Abbild. Beschr., 2, p. 166, pl. 3. fig. 26.

1847 *Litorina ventricosa* Philippi, Abbild. beschr. 3, p. 51. pl. 6 fig. non p. 38.

1936 *Littorina chaoi* Yen, Musee Heude, Notes Malac. Chinoise, 1 (3), p. 3.

1937 *Littorina chaoi* Yen. *l. c.*, 1 (4), figs. 2, 2a, 2b.

1941 *Littorina picta* Kuroda, Mem. Fac. Sci. Agr. Taihoku Imp. Univ., 22 (4) p. 82, pl. 6, figs. 7, 8.

Length 8.2mm., breadth 6.0mm. (examined specimen collected from Shirahama, Wakayama Pref.).

Type locality: Hawaii Islands.

Distribution: Pacific Region: Formosa to Honshu.

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**New parasitic gastropods**

1. *Stilifer utinoumii* n. sp.

Shell moderate in size, thin, oval, semitranslucent, polished, with weak growth lines; apex broken in the type specimen, but probably mucronated; whorls 5, except the broken mucro, each whorl somewhat convex; suture weakly impressed; body whorl rather large, longer than a half of shell-length; base moderately inflated: aperture oval, being sharply angular at the posterior corner and roundly arcuated at the anterior; columellar margin somewhat thickened, outer margin extending rather far forward and then restricted at base. No operculum.

Height 8.9mm., breadth 5.0mm. (mucro missing).

Host: Imbedded in the swelling on the arm of *Linkia guildingii* Gray.

Locality: The neighbouring sea of the Seto Marine Biological Laboratory, Sirahama, Wakayama Pref., Honshu.

Remarks: The specimen was secured from a specimen of the seastar, *Linkia guildingii* preserved in our laboratory. This snail is similar to *Mucronalia eburnea* in its shape. It is not operculated, however, and the shell is covered with the pseudopallium. The species is distinguished from all known Stiliferids in that the shell is oval and without the sharply pointed early whorls,

and the body whorl is higher than broad, and has a rather weakly rounded base.

2. *Stilifer ophidiastericola* n. sp.

Shell small, pellucid, and with a line bordering the suture beneath, oval; spire pyramidal; whorls 6, of which two form the mucronated apex, bending to right, each whorl rather flattened; suture weakly impressed; body whorl large, occupying two thirds of shell length; aperture oval, pointed at the posterior corner and rounded at the anterior, outer margin somewhat extended forward and not umbilicate. Operculum absent.

Height 3.5mm., breadth 2.2mm.

Host: Imbedded in the swelling on the arm of *Ophidiaster cribrarium* Lütken.

Locality: Tomioka, Amakusa, Kyushu.

Remarks: This species resembles the young of *St. ovoidea*, but has less sharply pointed early whorls and a smaller body whorl. *St. sibogae* is also a species allied to this, but has more convex whorls and a very large body whorl.

3. *Balcis soliduloides* n. sp.

Shell rather small, stout, slightly curved backward, solid, milky white smooth and highly polished, apex rather small, and niveous white in colour; whorls 10. each whorls rather flattened; suture impressed; body whorl about a half of shell length; varices rather irregular and running up on right side; aperture oval, pointed above, outer magin running forward, but restricted on the base; operculated;

Height 7.5mm., breadth 2.8mm.,

Host: A large black sea-cucumber, yet undetermined; on the skin.

Locality: Suo, Formosa (collected by Mr. Kuroda and reported as *Balcis acicula* Gould by him.).

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